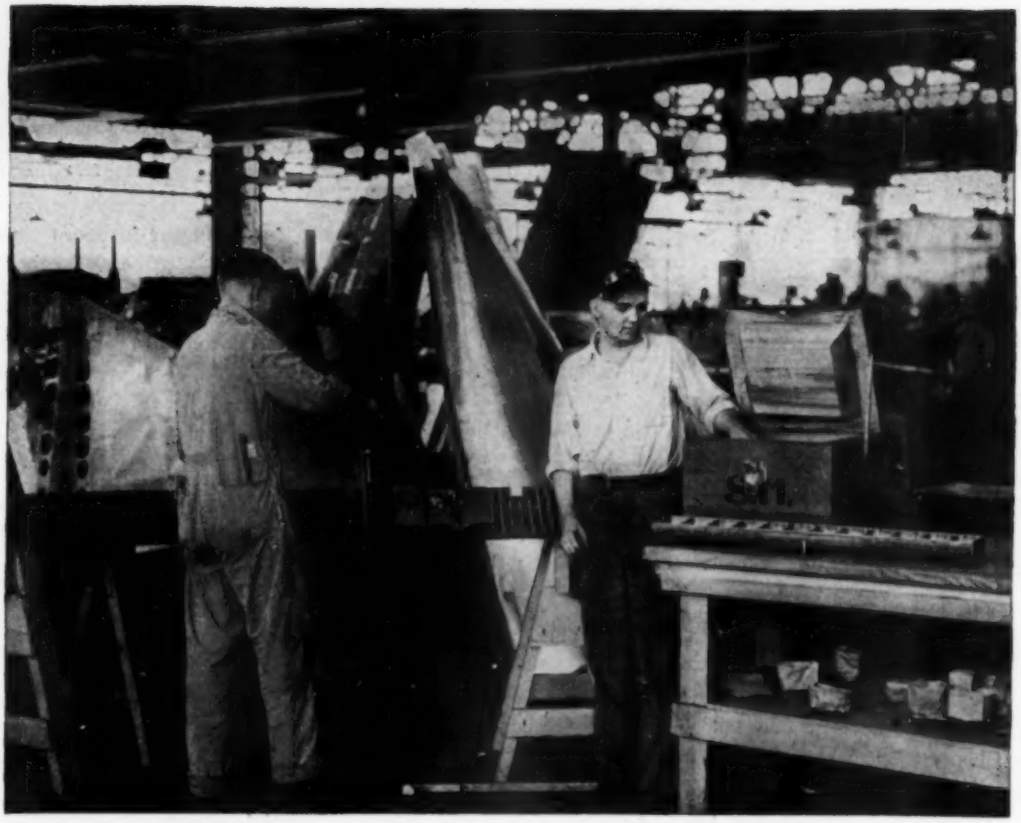
American Machinist

Established 1877
McGraw-Hill Publishing Company, Inc.

New York, September 17, 1931



A rivet "icebox" in use in a section of the Boeing plant's sheet metal department, Seattle, Wash., where a dural aileron is being assembled by riveters

# Cold-Treating Dural With Solid $CO_2$

**Age-hardening of Duralumin has caused dozens of fabrication difficulties, but now the "icebox" preserves the results of heat-treating by providing its opposite**

THE old familiar "icebox" that has done such yeoman service in the home now finds itself adopted for shop use—paradoxically not to offer a new use for metal so much as to preserve metal for use. Its adoption and adaptation solves one former difficult problem—the problem of preventing age-hardening of duralumin-type alloys until they can be fabricated.

With the increasing use of metals in the construction of aircraft, the problem of forming these alloys, particularly in the case of rivets, become serious. All sorts of difficulties were encountered. It will be remembered that the Glenn L. Martin Co. found it necessary to install electric furnace equipment for precision heat-treatment within a plus or minus 10-deg. temperature variation (*AM*—page 853, Vol. 73), and to install an overhead monorail with an electric crane to transfer the charge of rivets from furnace to quenching bath in minimum time. Martin found it vital to use rivets within one hour after annealing, rivets being distributed to the various riveting stations in pans of two different colors, one color for one heat, the other for the next, immediately after quenching. The old rivets were collected at the same time to prevent their use. Benches and floors were kept clean of rivets; it was a shop rule that one was never to be picked up and used.

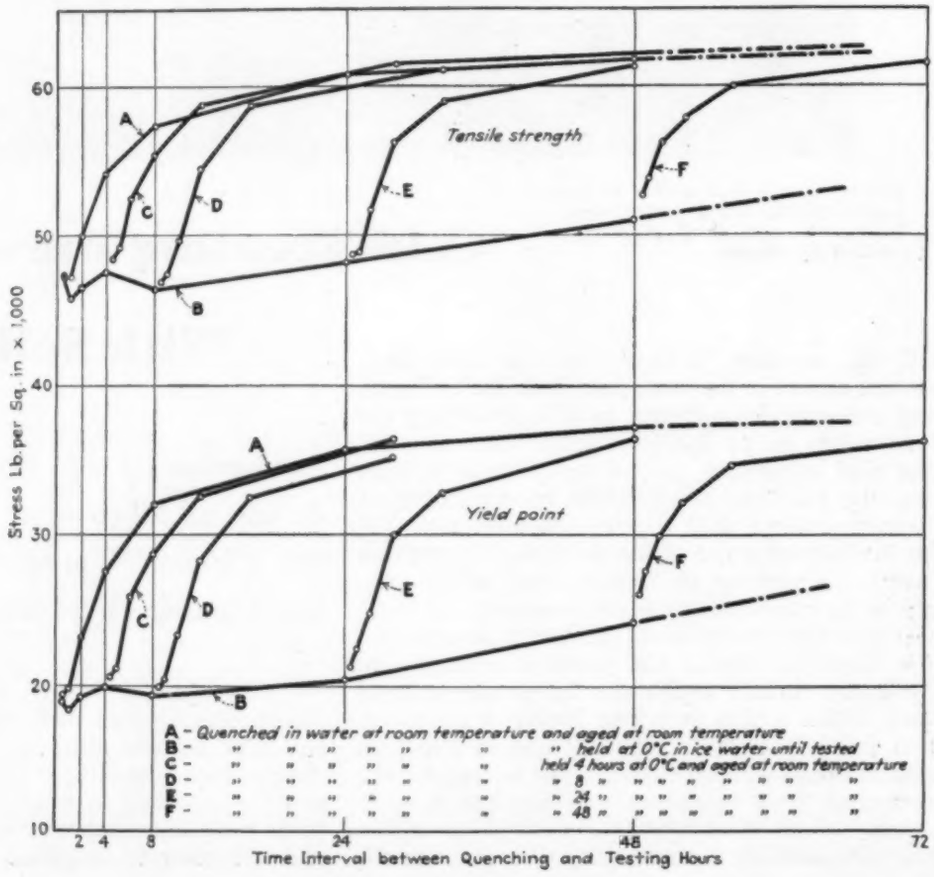
Practice in many other plants was somewhat similar, differing largely in details. The Curtiss Aircraft Co., for example, heat-treated rivets at a temperature of 700 deg. F., quenched them in cold water and used them within 20 min. The Boeing Airplane Co., shortened the usable time to 15 min. following treatment. Rivets there were heat-treated in molten salt at a temperature of 950 deg. F., then quenched. It was necessary that the Duralumin-heat-treating unit be in continuous operation, and that boys constantly supply riveters with fresh rivets, returning rivets which had passed the 15-min. limit for re-treating. Such a procedure had the obvious disadvantage of being uneconomical, and furthermore offered the nagging possibility that workmen would use the rivets after the time limit had expired, or the supply being depleted, might use some that had not been heat-treated. In the first instance, incipient cracks would develop and later open up and cause failure, in the second, difficulty from corrosion might be experienced.

A short metallurgical explanation shows the reason for this rapid age-hardening. The desirable high strength and hardness of the heat-treated strong aluminum alloys result from two distinct structural changes, first, the formation of a solid solution by heating at the required temperature for a sufficient time, followed by substantial retention of this solid solution by rapid quenching; second, precipitation of the particles to a critical grain size to produce maximum strength and hardness. In alloys of the Duralumin type containing both copper and magnesium silicide this precipitation takes place at normal atmospheric temperatures, in contrast with the alloys containing only one or the other of these alloying elements where maximum properties are obtainable only after accelerated aging treatment produced by heating for 15 to 20 hr. at 150 deg. C. (302 deg. F.).

Metallurgical experiments show that alloys of this Duralumin type age very rapidly during the first 24 hr. and that aging is substantially complete after four days. Consequently, any method of retarding the aging at room temperature would be of considerable advantage.

It is interesting to note that the solution was not an outcome of research but of shop observation. It points the moral that no matter how extensive research may be, no plant can afford to neglect the sensible observations of men in the shop. Several years ago, heat-treatment of Duralumin rivets was being carried out in the manner described at one company's plant. Somehow or other a container of rivets was placed outdoors on a window sill after quenching. The temperature was low, around 20 deg. F. The rivets were forgotten overnight, but when tried next day were found to be as malleable as though they had just been heat-treated. This astonishing result was referred immediately to the officials, but no research on the problem was undertaken at that time. About a year ago, however, several other aircraft manufacturers heard of this method of retarding age-hardening, and their combined queries resulted in a study by the Aluminum Research Laboratories. Results showed that age-hardening of Duralumin can be satisfactorily retarded for at least 24 hr. by storing the material at about 32 deg. F. immediately after quenching. Apparently there was only slight difference, no matter how specimens were kept, in the values for tensile strength for about 2 hr. after quenching; however, after this interval the values for material held at 32 deg. F. remained constant for 24 hr., while that for material at room temperature increased fairly rapidly, until at the expiration of 8 hr. the material had attained about 95 per

**Comparison of properties of Dural aged under various conditions**


Tensile strength
Yield point
Stress Lb. per Sq. in. x 1,000
60
50
40
30
20
10
A
B
C
D
E
F
2
4
8
24
48
72
Time Interval between Quenching and Testing Hours
A - Quenched in water at room temperature and aged at room temperature
B - " " " " " " " held at 0°C in ice water until tested
C - " " " " " " held 4 hours at 0°C and aged at room temperature
D - " " " " " " " 8 " " " " " " " "
E - " " " " " " " 24 " " " " " " " "
F - " " " " " " " 48 " " " " " " " "

cent of the hardness it would attain in a period a dozen times that long.

An accompanying graph shows these results. In this graph the mechanical property values of the specimens tested are compared for material quenched in water at room temperature and aged at room temperature, and for material quenched in water at room temperature and maintained at 9 deg. C. until tested. In the latter instance it should be noted that, even though the material was quenched in water at room temperature, the storage at the low temperature had substantially retarded age-hardening for at least 24 hr. These two sets of curves are marked *A* and *B* respectively on the graph. Curves *C, D, E,* and *F* represent material quenched in water at room temperature and maintained at 0 deg. C. for 4, 8, 24, and 48 hr. respectively and then allowed to age for various periods at room temperature. Thus, for instance, the first point on curve *C* indicates that the material was tested 4½ hr. after quenching but the material was held at 0 deg. C. for 4 hr. of this period and then aged ½ hr. at room temperature. These same data apply to the first points on curves *D, E, F,* except that in these instances the holding time was 8, 24, and 48 hr.

The rate of age-hardening, as shown by the slope of the tensile strength and yield point curves *C, D, E,* and *F,* is apparently the same whether the material has been held at 0 deg. C. for 4, 8, 24, or 48 hr. subsequent to aging at room temperature.

Inasmuch as age-hardening proceeds at the normal rate when the material again attains room temperature, it is imperative that severe forming operations be carried out within the usual periods of ½ to 2 hr. subsequent to removal from the low-temperature storage, preferably within the half hour.

These results were announced by E. H. Dix, Jr., and F. Keller, metallurgists of the Aluminum Research Laboratories, at the Chicago meeting of the A.I.M.E. a year ago this month. Immediately ice water, brine, and mechanical refrigerators of various types were pressed into service for cold-treatment, but these methods, while they eliminated the frequent heat-treating formerly necessary, did not reduce the necessity for regular exchange of rivets, since none of them offered the desired portability. The solution was apparently hit upon by several companies at about the same time, in April or May of this year. Solidified carbon dioxide, the "DRY-ICE"* of commerce, was tried as a refrigerating medium. Curtiss Aircraft Co. at Buffalo uses a cubical box made of balsa wood 1 in. thick. The box is a 9-in. cube on the inside. About 7 lb. of "Dry-Ice" is placed in a 6x6x9-in. metal container fitted in the center of the box and surrounded by 12 compartments containing various sizes of rivets. The temperature of the rivets in these boxes is about minus 20 deg. F. Company practice is to heat-treat rivets on Monday, after which compartments in the individual boxes are filled with the assorted sizes. The boxes are kept iced continually, and no more rivets are heat-treated during the week unless riveters run out of some particular size. Seven of these boxes are in use at this plant, one for each construction gang. The riveter simply takes a rivet from the box at his elbow, driving the rivet immediately.

Boeing Airplane Co. uses a box with interior dimensions of 9x11 in. and 5 in. deep. Around this is placed a 3-in. layer of balsa wood and the whole is housed in a ¾-in. shell of fir plywood. A small compartment is fabricated of screen for the "Dry-Ice," and screen trays are installed for the rivets. The screen permits effective circulation of the cold. Ten of these boxes, as well as a larger master storage box, are now in use. The "Dry-Ice" is wrapped in paper, since without wrapping it creates a temperature lower than necessary. The average temperature is approximately 30 deg. F. Heat-treating there is done daily, the boxes being distributed immediately after the quenched rivets are placed within them. Since age-hardening theoretically begins immediately after quenching, no time is lost in putting rivets in the boxes.

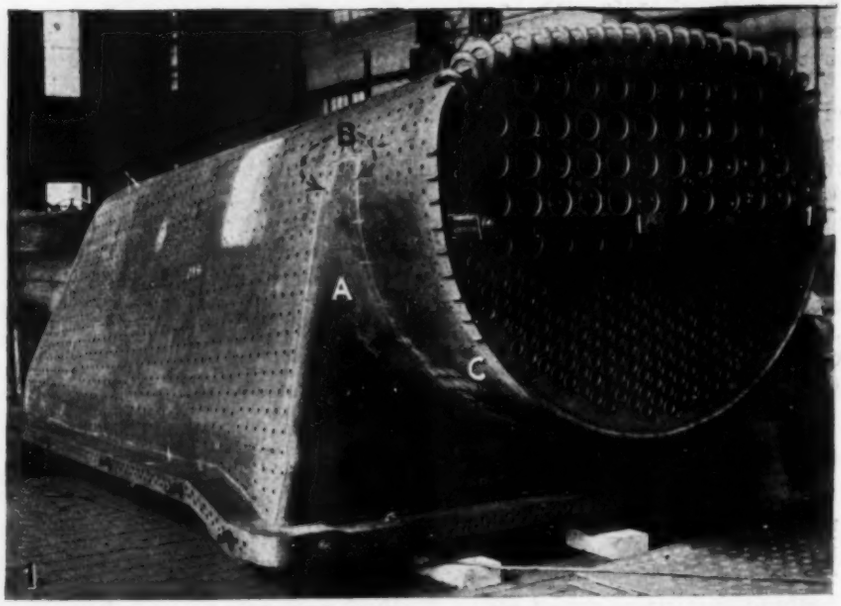
Similar procedure has recently been adopted by the Naval Aircraft Factory at the Philadelphia Navy Yard, and by some other companies, including Sikorsky. Incidentally, one unusual condition offered a problem for a time. It was customary to quench the rivets in water and to place them in the boxes immediately. Thus the water remaining on the rivets was frozen and remained so until the rivets were driven. Then the ice melted and caused trouble in joints. This is now being avoided by quenching in oil.

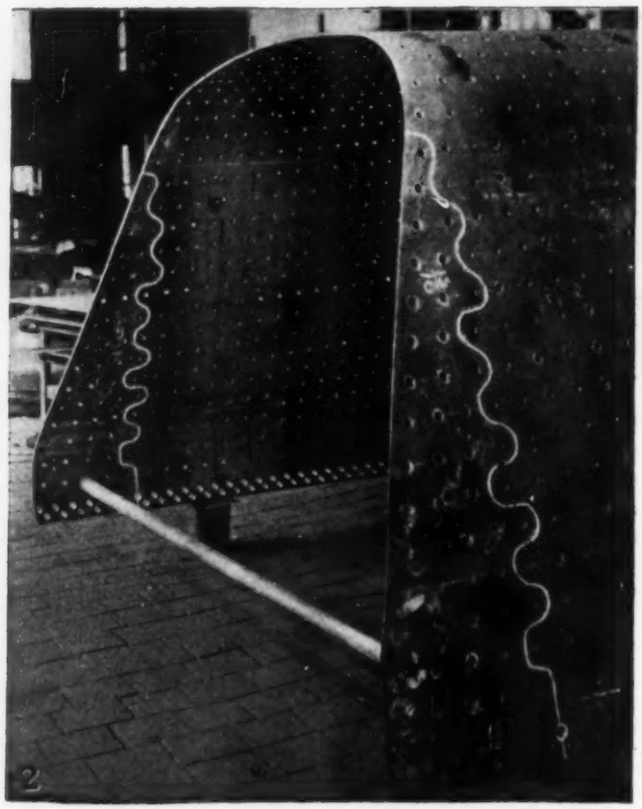
Considerable reduction of expense has been reported by this method of cold treatment, Boeing, for example, using only 100 lb. of "Dry-Ice" weekly for the rivet boxes. The amount necessary is, of course, dependent upon the temperature desired. The most efficient temperature has not yet been determined, that is whether it is just as efficient to keep rivets at 32 deg. F., 0 deg., or at —20. If the temperature is too low, the rivets will "burn" the workman's fingers, causing intense discomfort. As a matter of fact, by proper arrangement any temperature as low as —110 deg. F. may be maintained. The question of economy of course enters, in that the lower the temperature, the more "Dry-Ice" is required. Some answer to this problem will be available in November when a joint experiment of the DryIce Corp. of America and the Aluminum Research Laboratories is completed. These companies have been keeping a variety of aluminum alloys at 110 deg. below zero since early in May. When concluded, this experiment may yield some interesting results. Again, if various temperatures were to be plotted against the relative times the rivets remain soft, a point might be found that would be the most efficient temperature at which to hold them. The solid $CO_2$ used as a refrigerating medium is of course comparatively more expensive than refrigeration caused by other means, but offers portability.

The growing use of metal, particularly the Duralumin-type alloys, offers greater possibilities for this refrigeration system. Perhaps future development may culminate in a rivet refrigerator closed constantly, delivering rivets through a trip chute. In some cases where sheet Dural is shaped, it is necessary that the forming operation take place immediately after the heat-treating process, and it is entirely possible that this system of arresting age-hardening could be effectively applied to this sheet as well as to the rivets. Whether this statement implies that aircraft factories of the future will employ huge refrigerators for Duralumin plate storage, and whether similar treatment will arrest age-hardening and limit the necessity for heat-treating other metals, only the future can determine. One possibility is in cold-treatment of certain alloy steels to improve their tensile properties, machineability and hardness, described on page 473 of this number.

*Trademark for solid carbon-dioxide and the equipment for its use, manufactured by the DryIce Corporation of America.

# Welding Firebox Sheets in Large Boilers



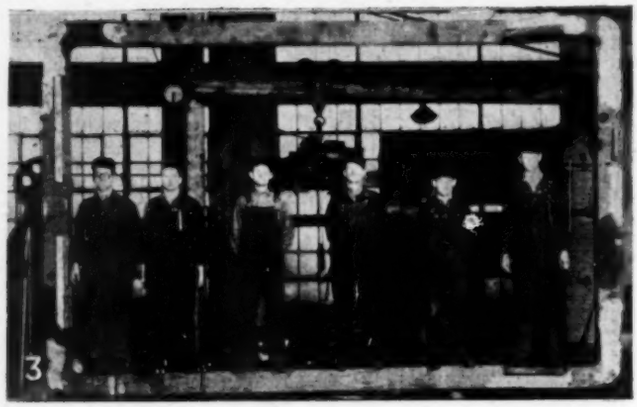




**Fig. 1—Inner firebox sheet, flue sheet and mud ring of a large boiler**

**Fig. 2—Extension on side sheet with sinuous seam to avoid staybolt holes**

**Fig. 3—Mud ring on machine, showing its size**

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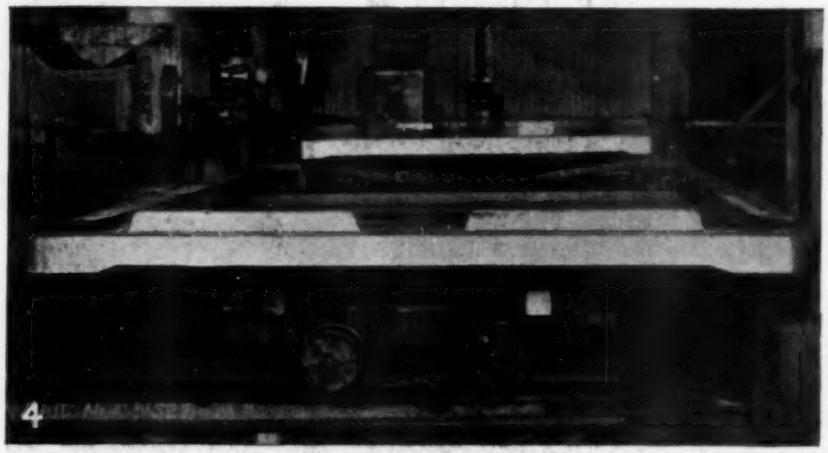
FIREBOX construction for modern locomotives has developed many interesting phases, some of which are shown in Fig. 1. This is the inner shell of a firebox that is made from a $\frac{3}{8}$-in. sheet 262x196 in., the largest sheet rolled to date. Even at that it has to have an additional piece welded on the back as seen by the serpentine seam at the corner. It weighs about 5,900 lb.

The design of the front end of the firebox obviates the necessity for a deep flange on the throat sheet as can be seen at *A*. The main sheet is cut out at *B* to receive the throat sheet *A* while the front end of the main sheet is curved as at *C* to form the support for the back flue sheet. The use of welded seams makes this an easy construction to handle. Another interesting feature is the use of heavy, forged corner braces at the top of the firebox. It will be noted that these are of thin section in the angle that is welded to the two sheets to permit as much water contact as possible. At the same time the heavy outer section prevents distortion of the sheets. This bracing shows one of the advantages of welding. It would be impossible with riveting. Welding also simplifies the joining of the throat to the main sheet.

The addition that is necessary to even the extremely wide sheet mentioned is shown in detail in Fig. 2. The fitting of the two parts is done by laying the extra corner



*Photographs by courtesy of Norfolk & Western*

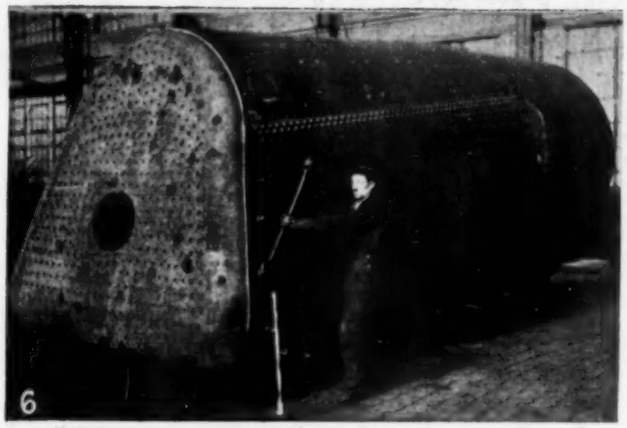


**Fig. 4—Temporary side car for supporting overhang while planing**

**Fig. 5—Inside of outer firebox shell, bolting on sling stay supports**

**Fig. 6—Getting the outer shell ready for riveting**

piece over the main sheet and cutting both with a torch at the same time. This insures correct fitting of the parts and makes it easy to weld the joint. The cut is laid out in a sinuous curve both to avoid the staybolt holes and to give more area of contact in the joint. This extra piece is a corner from the main sheet and so does not involve extra cost for material.

The mud ring itself is something of a problem owing to its size and weight, for the ring is 121x185 in., of 4¾x7-in. section, and weighs 5,929 lb. in the rough. Machined and ready for drilling it weighs 4,683 lb. An idea of its size may be had from Fig. 3 where it is shown bolted to the table of a machine. It is supported at the end, and frames six men. Machining a mud ring of such dimensions requires careful handling. The radii inside the corners are milled, this providing a clearance for the planer tool. The planing is done on a large openside with a support for the overhang as in Fig. 4. The wooden truck and temporary tracks shown were a makeshift, and a metal framework with permanent track in the floor is now in use. The principle remains the same and enables the huge mud ring to be handled without difficulty. The outside corners are also milled to radius and the sides planed, as the ring must make a water-tight joint with the inner and outer sheets of the firebox.

Two other views, Figs. 5 and 6, give a further idea of the size of the modern locomotive boiler, not the same one previously shown. Both views show the outer shell which is riveted instead of welded. Fig. 5 gives a rather startling idea of the size of the outer shell. In Fig. 6 the outer shell is being bolted in place preparatory to riveting. Holes in the mud ring and in both the inner and outer sheets are lined up with the long drift pins shown. Considering the high pressures now carried and the vibration and racking to which a locomotive boiler is subjected, the results speak volumes for the care in both design and workmanship.

# EXECUTIVE

## Iron and Gold

**Many plants distribute administration, engineering, and selling expense on a flat percentage basis over the shop and foundry alike. Does this put too great a burden on casting costs? Should an attempt be made to allocate these charges more equitably. Special patterns are generally charged directly to a specific order. But stock patterns are sometimes charged to development to be distributed over future orders and sometimes to foundry overhead. Should the foundry be treated by the accounting department as though it were a separate unit, selling castings to the machine shop? Or should it be treated simply as another manufacturing division? What do you think about this executive problem?**

TO Dave White, Foundry Superintendent of the Channing Metal Works, costs were a necessary evil in a manufacturing plant. Passively, he tolerated accounting procedure but took little interest in its inner workings. Knowing this viewpoint, James Hilton, Chief Accountant, was surprised when White visited his office one morning.

"What's on your mind, Dave?" Hilton asked, sensing a question from his visitor.

"Craig's been checking up on all his manufacturing costs," said White referring to the works manager, "and he's been riding me pretty hard on foundry efficiency. He's gone so far as to secure outside quotations for rough castings on some of our standard parts and claims that the prices are lower than those from our own foundry. Naturally he wants to know why and so do I."

"Where do I come in?" asked Hilton.

"Our foundry's run efficiently," said White, "and I know we're making castings just as cheap as those outsiders who gave Craig the prices. Besides, they have to make a profit and we don't. I've never bothered much with our cost methods, figuring it was all in the family. But the way it's been put up to me makes me take interest. I want to know what part of our rigmarole makes that difference in price."

"I can set you straight on one point right away," said Hilton. "We charge a profit on the foundry output just as we do on our finished product. There's no reason why each step in our manufacturing process shouldn't stand on its own feet."

"It's just a matter of which end of the shop you want to tack on the profit," said White. "But how about all this overhead. My cost reports show administration, engineering, and selling expense, pattern shop overhead, pattern changes, besides the usual light, heat, and power charges."

"Is there any reason why the foundry shouldn't take its share of the general overhead items?" asked Hilton.

"It shouldn't be charged with anything it doesn't use," said White. "I don't get any help from our sales force or the engineering department and darned little benefit from our high-powered executives. I look at this proposition as though I owned the foundry and operated it independently. All I'd need would be myself and my foremen. The customers would supply the blueprints and I'd make the patterns and castings. Here I'm carrying a lot of expense that does me no good."

"Just a minute," said Hilton. "If you had your own foundry you'd soon find you needed overhead. You'd still have selling to do and costs to keep. These outfits with all the system under one man's hat are extinct as the dodo."

"Well, at least I wouldn't be carrying the engineering department's development expense," said White. "When those fellows come out with a new so-called standard machine, I'm charged with the pattern costs. Then they change the patterns a few times and finally discover the machine isn't as standard as they guessed it would be. If I were on my own, I'd get paid for each pattern as it was made and every change on top of that."

"We have to distribute the cost of stock patterns over a term of years and use that means of doing it," said Hilton. "Some of it is development, but after all, it's all one company."

"That's what I thought," said White. "But if they're going to compare my costs with outsiders I want them figured on the same basis."

# FORUM

## Discussions Of Former Subjects

### Marking Time

No new design is completed upon a drafting board. There are always bugs to be worked out during actual construction, which are best handled when there is not too much pressure and rush upon the building of the first unit. If held back for a demand, the machine will really not be ready to meet it after all.

Buyers are usually reluctant to buy a brand new design. There are usually small difficulties of wear and functioning, not necessarily serious but mighty annoying, which are brought out in the operation of the first units of a given model. True, the machinery manufacturer is generally willing to correct these without cost, but the delay and tie-up is costly in itself.

Fixing selling price on a quantity rush, assuming you will not start to manufacture until the demand is such, is likely to be troublesome to the manufacturer, for he must base his costs on estimates rather than actual experience. Even from the purely selfish attitude the present is the best time to put new designs into production, for limited demand is a blessing and not a curse.

—CHARLES KLYNE.

### Filling the Gaps

Standard accounting practice has for its object the determination of the true actual costs of production of each product manufactured. From this information, the profit to be expected can be estimated from a study of market conditions. When other considerations than those of profit-making enter the picture, it is quite conceivable that accounting practice as applied to costs may need to be modified, if cost figures are to give a true guide in the solution of unusual conditions.

If the works manager considers it essential to keep his men employed and achieves this end by making parts normally purchased outside, then it is sufficient in my opinion to charge this work with material and labor, and only such overhead charges as are incurred additional to those existing in the plant before such work was undertaken. If the costs of the part are no higher than the outside purchase price, the costs taken over the whole of the company's products are not increased over the original figure. From the individual company's viewpoint, the result appears sound, but from the rational viewpoint it would surely tend to concentrate unemployment in certain unfortunate firms, instead of leaving all to bear the burden.

—S. A. KNIGHT,
*Irak Petroleum Company,*
*Kirkuk, Irak.*

### Shifting the Burden

Why should we sacrifice the human being to shift work for the sake of a few extra machines? We are striving every day to improve working conditions and make life more pleasant. It is not pleasant to be going to work when the rest are going home. Let the people work their day work and enjoy associations with their fellow men in the evenings and weekends.

Another difficulty in designing a plant for shift operation is that a major breakdown would place the company in a three times worse predicament than with a regular day shift. Most manufacturing plants require maintenance work at night if the machines are expected to run all day.

If a plant, which manufactures subject to a demand for its material, is built and equipped on a three-shift basis and is then faced with a sudden increase in sales, there is no factor of safety by which it can increase output.

If it were designed for a day shift only, a second or third shift could be put on to take care of this increase in business until the plant could be expanded.—HENRY GARGES.

### Hours Gratis?

I have worked a number of years both as a chief draftsman and on the board. When working on the board, my attitude toward overtime work was that the time which I had off for sickness or various other causes more than paid for the overtime I put in. When hiring draftsmen, I found it well to ask them if they were willing to work overtime. Then if occasion did come up for overtime work, there was no question about overtime pay.

—HERBERT A. PRATT,
*Clay Products Company.*

### Shirt Sleeves or White Collars?

This question of excessive control personnel and the fair distribution of enforced reductions in shop costs with reference to the "white collar" crowd has been a mooted one ever since the late Frederick W. Taylor, proved that a then-unheard-of increase in planning and supervisory force showed large returns in increased productivity of the actual direct labor.

Twenty years ago, the writer was involved in a reorganization of control methods for a well-known maker of motor vehicles, where an increase of approximately 125 per cent in what prior to that time had been classed as "overhead" labor, made possible a large increase in productive efficiency and lowered the costs of complete units by more than 30 per cent. There is a definite gain to be derived under certain conditions through a policy that apparently reverses the age-old principle, which calls for the holding of indirect labor outlay to a minimum in relation to so-called direct wages.

On the other hand, the writer recently had the opportunity for observing how differently the same theory worked at another plant. Individual circumstances must determine the extent to which planning organizations, functional foremanship, and other forms of indirect labor can be profitably employed. When the final decision is in favor of their employment, there should be a definite ratio set up to provide for the passing of a proper share of all cost reductions on to them.

It is unfortunate that during these times of few jobs, great unemployment, and acute economic and physical suffering, it is possible to get away with murder in exacting the

last ounce of blood from the payrolls. Also, and equally unfortunately, in the light of present-day competition and purchasing of the horse-trading variety, it is necessary to go to extremes in the way of shop cost reduction, when compared to normal time procedure.

I think labor generally recognize this fact, and if given a fair break and the assurance that an employer is not capitalizing on its distress to beat prices down, will cooperate to the limit.

—D. C. WRIGHT, *Works Manager, Graver Tank and Manufacturing Corporation.*

## One Line or Many?

A single line of products will always be found to be the most economically manufactured and sold. But this does not prove that the practice is always the most profitable. It has the attraction of possible high efficiency in both the making and selling ends. But it has all the disadvantages of subjecting the business to extreme fluctuations in sales volume caused by seasonal and other causes. Quite often, a varied line of products will enable the company to iron out the peaks and valleys in production and sales, but it will tend to make the business more complicated in every respect. When this policy is decided upon, diligent care should be used in choosing the new lines. The company should not wilfully invade a crowded field, unless it has something that is radically new or different.

Regardless of the policy decided upon, only the one or more products should be made which can be sold at a reasonably good profit. In the meantime, the engineering department should be continually searching for improvements as well as something new to introduce.

—L. O. BROWN.

A firm that manufactures a line of machine tools is not justified in taking up another line until it has captured the whole of the trade in their first line. They should expend their energy and capital in developing their designs and improving their manufacturing methods until no other firm would have the slightest chance of competing with them.

If a firm has about all the trade there is in its product, it is quite justified in taking up another line. If a firm is making a machine for which there is not a big demand, but for the manufacture of which it needs a considerable amount of expensive machinery that will not be employed full time, it may be necessary to take up other lines to find work for the machines that would be otherwise idle for part of the time.

—HARRY SHAW, *Consulting Engineer, Heywood, England.*

The one-line business wrecks strewn along the industrial highway during the past twenty years are convincing answers to lack of diversification. Little companies founded on the sound principle of diversification have taken over through merger or purchase many of the one line concerns at from ten to fifty cents on the dollar. This has applied with striking regularity to power transmission manufacturers and lathe builders. Even the most recent industry, radio set manufacturing, has learned this bitter lesson. Present conditions make diversification a program much more important than in normal times. A large metal-working plant is doing from seventy-five to eighty per cent of normal business due mainly to competent sales efforts and diversified products. —E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Company.*

## Who Buys?

As the purchasing department is one of the largest spenders of the company's money, the purchasing agent should be directly under the supervision of the president. All questions on the quality of materials should be referred to the chief engineer, as he has the responsibility of advising the rejection or acceptance of bids by reason of his technical knowledge of the requirements of manufacturing departments. He should consult the heads of departments and advise as to the quality of materials, for in some cases it is possible to save considerable money by taking a lower price. It would not be good business to buy easily machining metal for parts requiring little or no machine work. The use of common sense, an understanding of the other fellow's problems, and no evasion of responsibiliy is required for the building of a successful organization.

—JOHN S. ISDALE, *Plant Engineer, International Silver Company.*

## Does Frankness Pay?

A man with a dead-end job is entirely warranted in working toward securing a position elsewhere provided he doesn't neglect his present job while seeking another. To tell the president that he is dissatisfied would probably cost him his position. There is nothing disloyal in seeking other work. Were the company dissatisfied with a man's work it would lose no time in giving him notice, after securing another man for the position. A man might remain in a position through a mistaken sense of loyalty, believing his work to be appreciated by the organization; he might let other and better offers go by only to find that all the time that organization was looking for a man to take his place. We owe something to the organization which employs us; but we also owe something to ourselves. Let the man find the position he wants, and then and not till then lay the matter before the executives. —EUGENE ARMSTRONG.

## Why Conventions?

Conventions are valuable because they enable those who attend them to acquire useful information in a form in which it is most easily remembered. True, the papers can usually be read afterwards, but their contents lack the life imparted to them on the platform. Conventions also provide unique opportunities for executives to get together and thus obtain a better perspective. They prevent a man from getting so close to his job that he cannot see the whole of it. These events are often held in industrial districts and visits are arranged to the important works in the vicinity. These visits are of value in supplying new ideas.

A certain amount of recreation and entertainment are essential in all convention programs. The secret of making the best use of conventions is to send a different representative to each one and to circulate his report round the whole works. Exhibitions are usually classed as prestige advertisements and as such, they are undoubtedly valuable. However, they are frequently of even greater service, as they enable a customer to obtain an instant impression of how a particular product will be of use to him, even if he has never previously considered its purchase.

—E. N. FARRAR, *Ipswich, England.*

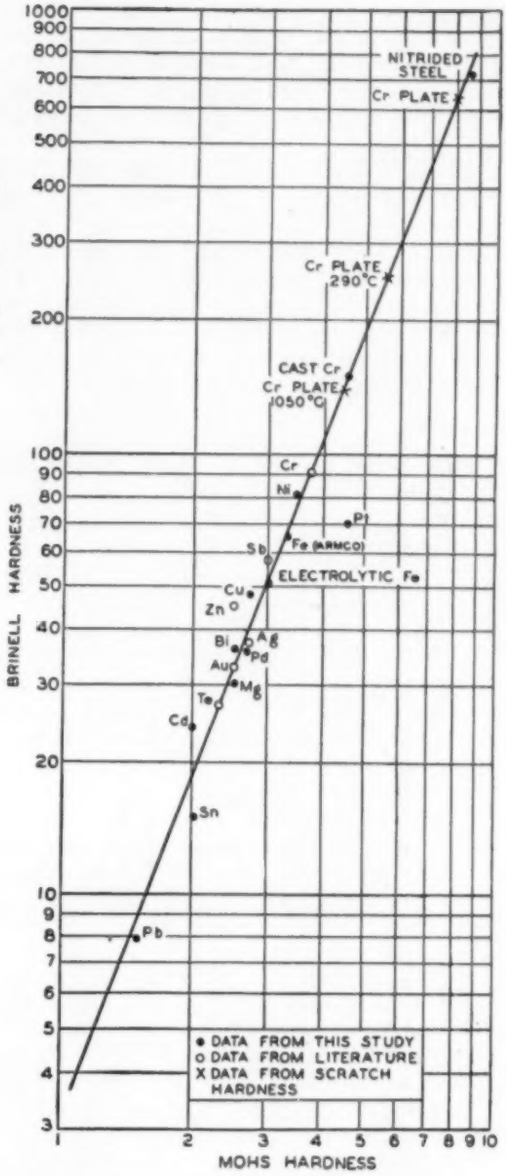
# Metal Congress Papers

**High spots of certain papers to be presented at the National Metal Congress and Exposition, Boston, selected for their particular interest to executives and operatives in the industry**

DISCUSSING "Tool Steel from the Consumer's Standpoint" in an A.S.S.T. paper, H. G. Keshian advocates that its properties be accurately determined and made available to the consumer in definite and numerical values, in the same manner as properties of S.A.E. steels. One effort in this direction is "Some Physical Properties of High-Speed Steel" by Joseph V. Emmons, which discusses results of a study on 18-4-1 high-speed steel. According to Mr. Emmons, a measurable amount of plasticity is demonstrated in hardened high-speed steels at all heat-treatments, variations appearing to be governed largely by the troostite content of the structure. Strength appears to be largely dependent upon the quantity and nature of martensite present, as does hardness. This is, however, almost entirely a metallurgical discussion, and what is desired is a definite method of rating that the shopman can understand and use.

Comparing physical and chemical properties of tungsten and tantalum and their carbides, Floyd C. Kelley in "Cemented Tantalum Carbide" describes the methods of manufacture, the varied physical properties obtained by using various binders, and the results of comparative physical tests of tantalum- and tungsten-carbide tools. Tantalum carbide has a lower coefficient of friction than tungsten carbide, requiring less cutting power, generating less heat and causing less wear of the tool. Comparative tests on 3½ per cent nickel steel with 0.35-0.40 per cent carbon and a Brinell hardness of 219, using a $\frac{5}{16}$-in. cut, 0.25-in. feed and a speed of 180 ft. per min. showed the average life of tungsten-carbide tools containing 13 per cent cobalt as a binder was 15.4 min. and of those containing 6 per cent cobalt 26.2 min. Tantalum-carbide tools tested under the same conditions ran up to 40 min. without any sign of breakdown. Tantalum-carbide tools tested on steel under shop conditions at relatively high speeds gave finer finish, uniform size of turning over long sections, ease of cutting, and long tool life.

Discussing "Corrosion-Resistant Steels," R. L. Duff concludes: "No metal has been found to meet successfully all corrosion problems, nor will it be, and the time seems to have arrived when a particular alloy will be used for each purpose." The "Manufacture, Properties, and Uses of 18-8 Chromium-Nickel Steel Wire," by W. H. Wills and J. K. Findley, outlines the process of production and physical properties of this wire and lists principal applications. Excellent properties of ordinary carbon steel wire limit applications of the alloy. 18-8 wire shows the best general resistance to corrosion, as well as



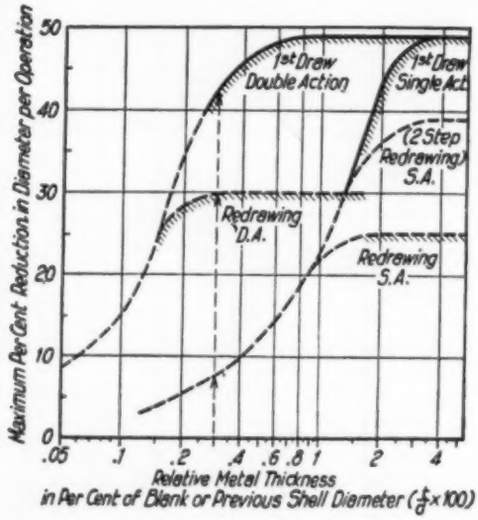

**Relationship between Mohs hardness and Brinell hardness of annealed materials**

good physical properties, having a yield point of 40,000 lb. per sq.in. and a tensile strength of 90,000 in the soft condition. The yield point rises with the tensile to 260,000 lb. per sq.in. with drawing. T. S. Fuller, studying "Endurance Properties of Some Well-Known Steels in Steam," found endurance properties of a nickel steel and a non-corrodible chrome iron, in the absence of appreciable quantities of liquid water and oxygen, to be not adversely affected by steam atmospheres up to and including pressures of 220 lb. and temperatures of 371 deg. C. (700 deg. F.). 18-8 alloy was seriously affected by long exposure to temperatures of 650 deg. C. (1,200 deg. F.) and above.

H. T. Morton and I. A. Rummler, in "Thin Strip Steel for Deep Drawing," show that the same kind of tests hold for thin strips of both hot- and cold-rolled steels for deep drawing operations, but that the limits are slightly different. Good hot-rolled steel should have a Rockwell hardness, B scale, of 45 to 62. It should not crack, roughen, or break during a 180-deg. bend test. Cold-rolled steel should have a Rockwell of B35 to B55,

should not crack, roughen or break in a 180-deg. bend test flattened out, and should have a bright surface free from defects. These authors claim that bend and laboratory tests give accurate information on drawing quality and structure.

E. V. Crane, in "Plastic Drawing of Sheet Steel," states that extreme plastic movement or rearrangement of metal (cold), illustrated in drawing round shells, develops principles which may be applied also to rectangular and irregular shapes. He discusses at length the various effects on the sheets in drawing and prepared the accompanying tentative chart to determine how much of a reduction may be made in single-action or double-action tools without causing flange wrinkles. Mr. Crane




also discusses surface markings, shell breakage and reductions, breakage due to strain hardening, annealing troubles and die construction. He considers the primary stress is the tensile stress in the shell wall which is rarely in the necking range and often below the yield point. The resultant compressive stress in the flange area during drawing must always exceed the annealed yield point and often rises to necking range stresses well above the nominal ultimate tensile strength. The extensive metal movement in this area causes strain hardening of the crystal structure at a predictable rate. Press operations and drawing operations in particular require development of plastic working theory and physical properties which describe the metal above its annealed elastic limits. Such data assists in explaining the troubles met with and the limitations upon drawing operations.

According to Mr. Crane, the principal details to be watched in die construction are the corner radius of the drawing die, the metal clearance, the shape of the drawing punch, finish of the blankholding surfaces, and the die material.

The edge of the die over which the metal is drawn is usually held to a radius of four to six times the metal thickness. Too sharp a radius results in excessive thinning of the metal and unduly high resistance to drawing over the edge. A greater radius may be used where the metal is sufficiently thick with reference to its diameter to preclude a chance of wrinkling. Clearance between the punch and die is usually made considerably more than the metal thickness to permit thickening up and easy flow over the edges. If ironing is required, however, the clearance may be held down to the original metal thickness or less.

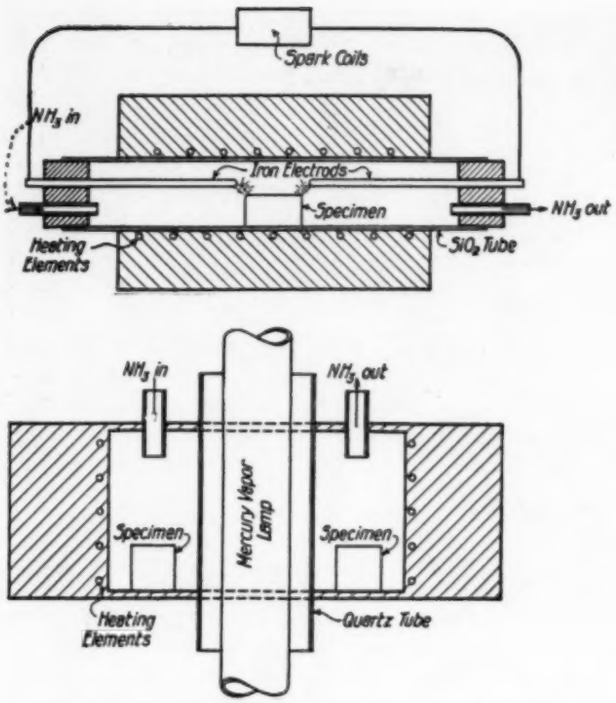
The nose of the drawing punch should also have a radius of four to six times the metal thickness in order not to cause thinning of the metal. In certain classes of operations where the shell is to go through several reductions a taper of perhaps 45 deg. may be used on the nose of the drawing punch, and a similar taper used on the blankholding surface of the next redrawing operations. It is essential to have a carefully finished surface, particularly on the blankholding surface and over the drawing edge. In shallow drawing operations or draws which involve very large unbalanced stresses as at the corners of rectangular shapes, it may occasionally prove necessary actually to arrange the blankholdnig surface to retard the flow of metal. This may be done by the insertion of draw beads, that is to say, a groove may be furnished in the die surface parallel to the drawing edge and a corresponding bead placed on the blankholding surface so that the metal flowing into the die must flow over the bead.

Samuel J. Rosenberg, studying "The Resistance to Wear of Carbon Steels," by means of the Amsler wear-testing machine (in which the material is subject to the combined rolling and sliding friction under heavy pressures) found that annealed carbon steels gave relatively low wear-resistance qualities for all carbon contents. Normalized steels showed low wear-resistance in the low-carbon range but have greatly improved wear-resistance in the high-carbon range. The hardened steels showed less wear-resistance in the lowest carbon ranges, but as the carbon content increased, the wear-resistance increased very rapidly until about 0.6 per cent carbon. Above this percentage the wear increased slowly. Tempering a hardened steel resulted in gradual lowering of its wear-resistance. Properly normalized high-carbon steel had almost as good wear-restance as hardened steel. Annealed high-carbon steel had relatively poor wear resistance.

A. B. Kinzel, discussing "Nondeforming Alpha-Delta Carburizing Steel" reports the production of carburizing steel on which the core has been rendered free from phase changes by additions of suitable amounts of elements such as silicon, vanadium, and chromium. This is a result of the observation that the large factor relating to distortion involving quenching of carburized steel is the volume change produced by phase changes in the core. These steels were found to carburize readily, and are suitable for industrial application where non-distortion is the prime factor.

Listing "Characteristics of Alloyed Cast Iron," F. W. Shipley says that increased quality can be obtained by additions of nickel and chromium to automotive-type cylinder iron. It was found that a ratio of three parts of nickel to one of chromium gave the greatest improvement in structure in conjunction with maximum hardness. The effect of prolonged heating on three representative plain irons, as well as on three nickel-chromium-alloyed irons of the same base composition, revealed a marked difference in favor of alloyed irons.

John J. Egan, in "Short-Time Nitriding," described several improved methods which result in appreciable cases in a much shorter period of time than is possible by present methods. Based on their efficiency, as measured by the depth of case produced in a given time, they may be broadly divided into two classes, the first including the use of ammonia-nitric oxide mixture, the electric spark, and high-frequency current heating; and the second, duplex cyanide treatment, ultra-violet light,




**Electric spark nitriding chamber (above) and nitriding furnace incorporating ultra-violet light source**

activated sand, and nitrogen-containing compounds. Of the more efficient processes, all included in the first group, the spark and the high-frequency current require further study before they may be applied commercially. The use of the ammonia-nitric oxide mixture, on the other hand, should fit rather readily into routine nitriding since the method involves no great departure from current practice save proper premixing of the gases and the use of copper gauze or chips. In addition, the production of cases 0.01 in. in depth in four hours should insure its ready acceptance by industry.

Discussing various "Lubricants for Deep Drawing," Maurice Reswick describes the development of oils and greases containing lead oleate. These compounds are known as "border-line" lubricants which maintain a good lubricating film above the point where the coefficient of friction ordinarily begins to rise rapidly. In a test with mineral cylinder oil, the load reached 7,000 lb. per sq.in. before the coefficient of friction began to rise rapidly, but between 8,000 and 10,000 lb. per sq.in., the film was practically all squeezed out. While the coefficient of friction for an equivalent lead oleate compound was slightly higher from the start, effective lubrication was maintained until 45,000 lb. per sq.in. was reached.

Summarizing his discussion on "What is a Neutral Atmosphere," Murray Winter explains that in an atmosphere of partially burned illuminating gas, it is possible to harden high-speed steel without decarburization and with a minimum of scaling when the carbon monoxide content is about 17 per cent; but one containing from 17 to 25 per cent CO will decarburize high-speed steel rapidly at 2,200 to 2,400 deg. F. Samples can be left in a neutral 25-30 per cent CO atmosphere for a long time without surface changes. His experiences pointed to the desirability of producing a neutral atmosphere high in carbon monoxide by some method other than those ordinarily employed. He believes that "Diamond Blocks" offer this method. They produce an atmosphere of about 28 per cent CO and maintain this constantly within about 1 per cent throughout their life, other gases being in such proportion as to maintain a balance between carburization and decarburization. The blocks are a specially processed mixture of carbonaceous and other materials, slotted to receive the tools to be heat-treated. A nickel tray is also frequently used, as this permits a number of tools to be hardened at the same time and prevents carburizing of the tools in direct contact with the block. Interaction of the carbon and other products on the slowly consuming surface of the block maintains the correct heat-treating atmosphere at all times. Tools hardened by this method have a gunmetal finish and have a surface film so thin that no allowance in size need be made for tools accurate to 0.001 in.

Summarizing his study of "Low-carbon Steel," H. B. Pulsifer discusses the effect of various types of treatment on steels formed into capscrews. He finds that a steel heated at 1,600 to 2,000 deg. F., then quenched in water or oil, has greater strength than the metal that results when capscrews are made from cold-drawn wire, but its yield point is lower. A cold-formed capscrew is thus difficult to improve upon by heat-treatment, for either brittle structures or structures having lower yield points are encountered. Reheating either a quenched or annealed case-hardened piece to 1,440 deg. F. and expecting a tough core is not in line with equilibrium conditions and runs contrary to a great deal of plant experience. The finding of tough cores after grinding off the cases from brittle pieces is attributed to uncritical testing. An extensive lack of detailed information about the microscopic structures appears to be the basis on which so many authorities recommend the usual double heat treatments. Higher magnifications quickly disprove the statements that the structure after a high-temperature quench resembles the original steel, or that quenching from 1,430 deg. F. causes no appreciable change after a quench from 1,625 deg. F. Basic steel containing 0.10 per cent carbon may be expected to case-harden and have a tough fracture on quenching from the box. On reheating and quenching from 1,440 deg. F., the fracture is rather brittle. The original wire, in which the fracture made by a hammer blow at a notched end is very finely crystalline, is easily made coarsely crystalline and highly brittle by heating to 1,625 deg. F., cooling to 1,325 deg. F., and sharply quenching in water. As far as Mr. Pulsifer's study warrants conclusion, the cold-formed capscrew has the best combination of properties and the single-quenched case-hardened part has the toughest core.

Summarizing his discussion of "Development of Continuous Gas Carburizing" R. J. Cowan gives the details of a new process for continuous gas carburizing. A hydro-carbon gas is mixed with flue gas containing $CO_2$ and introduced into a muffle containing work to be carburized, so as to move through in the same direction as the work. In the preheat zone of the furnace the hydrocarbon gas begins to break down, so that the work to be carburized soon becomes covered with a deposit of precipitated carbon. In the carburizing zone, active carburizing takes place because of the chemical reaction between this deposited carbon and carbon dioxide, which at these temperatures becomes effective. In the subsequent diffusion zone, the carbide case formed is allowed to penetrate toward the core to obtain proper gradation of properties. The metal, in passing progressively through these three zones, becomes carburized as desired by a proper regulation of time, gas flow and proportioning of mixture.

# Super High-Speed Steel

## Materials, heat-treatments, and rake angles are designed to meet demand for more chips per minute

**J. M. HIGHDUCHECK**

*Assistant Superintendent, Manufacturing Equipment Department, Westinghouse Electric & Manufacturing Company*

DEVELOPMENTS during the past two years serve to emphasize that metal-cutting tools in all of their diversified branches have become one of the most interesting subjects of the present machining age. Since the introduction of cemented tungsten carbide for metal removing, machinists have come to realize that revolutionary changes are forthcoming both in machine design and in the application of these newly developed cutting materials.

American production methods are based on the low labor cost that is made possible by the development of more efficient machines and tools. In this development, the metallurgist has played a leading part. History shows that lower production cost is brought about, first, by the introduction of a new cutting tool material, and second, by the development of improved machinery that utilizes the tool material to the best advantage.

The development of cutting materials has in general been continuous but may, nevertheless, be divided into four steps. The first of these was the use of plain high-carbon steel. The second consisted in the use of Mushet self-hardening steel. The third was the introduction of high-speed steel by Taylor and White. The fourth step, in the advance of the art of cutting metal, was the introduction of the tungsten and tantalum carbides.

Possibly because of the introduction of this last group, the producers of high-speed steel came to realize that unless they offered the market a grade of cutting material which will exceed the performance of the old high-speed steel, it would only be a matter of time before high-speed steel would be on the shelf. Practically every manufacturer of high-speed steel has recognized this situation, and many of America's most prominent laboratories are engaged in research to anticipate the needs of the machining industry in years to come—seeking ways and means for making cutting materials better and cheaper.

After several years' experimenting, the tool steel manufacturers were successful in placing on the market a grade of cobalt steel, which is sometimes called super high-speed steel. This grade of tool steel will be watched by machinists, because it offers a wide range of application for heavy cutting at much higher speeds and feeds than the conventional grades of high-speed steel.

In describing a subject, such as the art of manufac-

**A slow preheat is required for cobalt high-speed steel tipped tools before bringing them to the final temperature**

**The tip is brazed at the hardening heat by pressing it into position until sufficiently cool to set**

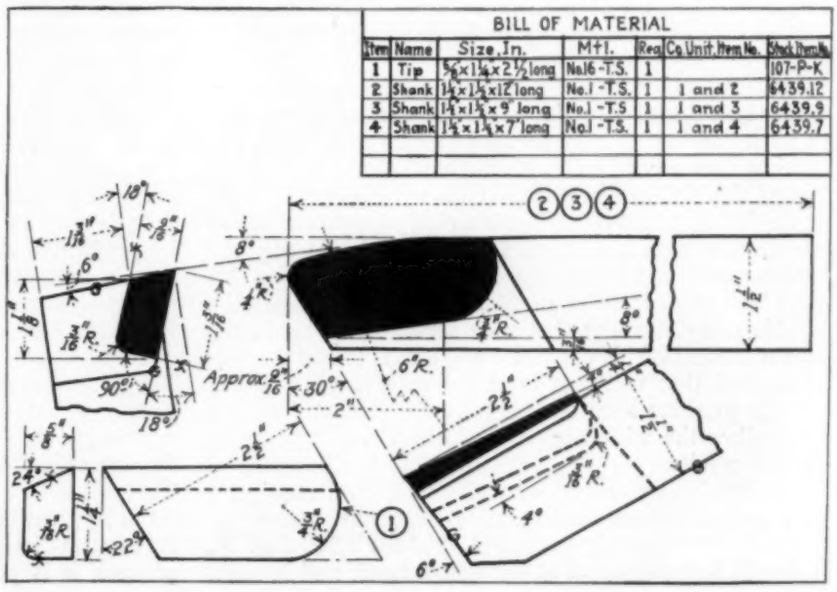
turing forged tools, using both the conventional grades of high-speed steel and the newly developed super high-speed steel grades, it is interesting to know where and when these grades can be used to the best advantage. Since we are dealing with the question of removing metal at the highest possible rate of speed and feed and in producing in the least possible time, it is only natural in this highly competitive age that keen interest must be paid to tool investment.

Standardization of past experience in the light of modern facilities, generally is profitable if properly applied. However, standards are only as good as they are recognized and lived up to. The chart on page 453 shows a complete list of forged tool shapes that are considered standard for every day production. Under the caption, "Description of forged tool shapes," each type (1, 2 3 etc.) is named in line with the appropriate application. Over the captions, "Lathe-Shaper-Planer" and "Boring Mill," are found the shank sizes and respective lengths which are permissible in production. The cutting edge of the tool is represented by a light line.

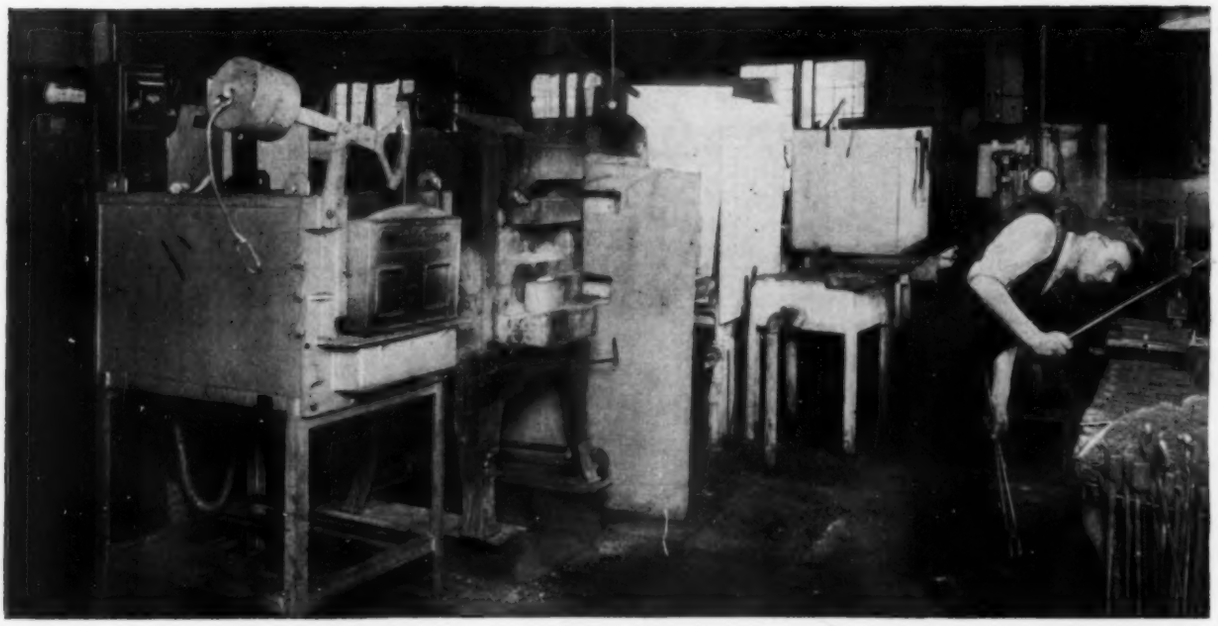
Experience shows that forged tools as illustrated in the chart in types 1, 2, 3, 6, 7, 11, 13 to 18 inclusive, 28, 31, 32, 36, 47, 60, 61, 122, 131, 132 should at no time be considered manufactured in tipped form. These types, in general, never are subjected to high speeds because of the nature of the work they are used for. However, the balance of the types illustrated in the chart, can be manufactured in tipped form only when the mean cross section of the shank is about $\frac{7}{8}$ in. or more. It is considered impractical to tip any shape which has less mean cross section than $\frac{7}{8}$ in.

Remember it is important to consider the shape and design of a tipped tool, especially when using high cobalt steel for tips. Avoid, if at all possible, the forging of the tips to the desired shape for the tool shank.

Design the required tipped tool so that virgin stock


BILL OF MATERIAL
Item | Name | Size, In. | Mtl. | Req | Co. Unit Item No. | Stock Item No.
1 | Tip | 5/8 x 1 1/4 x 2 1/2 long | No.16-T.S. | 1 | | 107-P-K
2 | Shank | 1 1/4 x 1 1/4 x 12 long | No.1-T.S. | 1 | 1 and 2 | 6439.12
3 | Shank | 1 1/4 x 1 1/4 x 9 long | No.1-T.S. | 1 | 1 and 3 | 6439.9
4 | Shank | 1 1/4 x 1 1/4 x 7 long | No.1-T.S. | 1 | 1 and 4 | 6439.7
2 3 4
1
Approx.
90°
30°
18°
22°
6° R.
2" R.
3/4" R.
3/8" R.
1/8" R.
2"
2 1/2"
6"

**Tipped tools should be designed so an excessive amount of forging or grinding of the tip will not be necessary**



**Preheating and hardening temperatures are closely controlled by electric heat instruments**

can be used; or in other words, use the steel from bar stock by cutting or sawing to the desired length. In the drawing, item 1 is the tip, designed so that bar stock can be used; to avoid excessive grinding for cutting angles, a machining operation is specified. The shank is milled to drawing dimensions and the high cobalt tip is brazed into position by a brazing compound called "Tipit," which consists of manganese and silicon, plus high-speed steel filings, and uses borax for a flux.

High-speed steel is one of the most complex alloys known. A representative steel contains approximately 24 per cent of alloying metals — namely, tungsten, chromium, vanadium, silicon, manganese; in addition, in the more recently developed so-called super high-speed steels, there is 6 to 12 per cent cobalt. In forging high cobalt steel, it is of paramount importance to heat slowly to a scaling heat—a lemon color, (1,800 to 2,100 deg. F.) and forge uniformly. Extreme care at this point must be exercised because forging at too low a heat tends to cause cracks, more so in high cobalt steels than in the commercial grades of high-speed steel. Therefore, reheat as often as is necessary to finish forging the tool to shape.

It has often been said that no cutting tool is better than the heat-treatment it receives. The heat-treatment of steel in its broad aspect may be said to commence with the melting furnace and end with the hardening and tempering of the finished product. One must not lose sight of the fact that heat treatment is a vitally important operation in the manufacture of a cutting tool. It requires hammer-men and hardening experts, each knowing his art. The manufacturer of high-speed steels knows the trouble and difficulties that may sometimes arise in the heat treatment of his product. His aim is to make a uniform steel that will best meet the requirements of the average machine shop on general work, and at the same time, allow the widest variation in heat treating to give desired results.

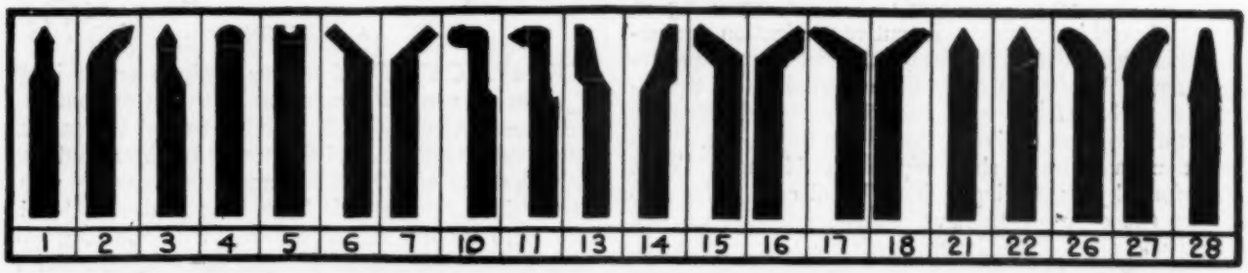
The hardening process of high cobalt steel requires a slow preheat before the hardening treatment. After the material is thoroughly preheated at about 1,500 deg. F., it should be transferred to the heat furnace and brought quickly to the hardening heat, 2,300 to 2,375 deg. F., brazing the tip at the same time. Then it should be allowed to cool in the air to about 200 to 225 deg. F., and drawn immediately to 750 to 850 deg. F. for at least one hour after the steel has reached this temperature. This operation should be controlled by heat instruments and by carefully pressing the cobalt steel tip in position until cool enough to set the braze. This treatment gives best results on tools which are subject to severe cutting and shocks.

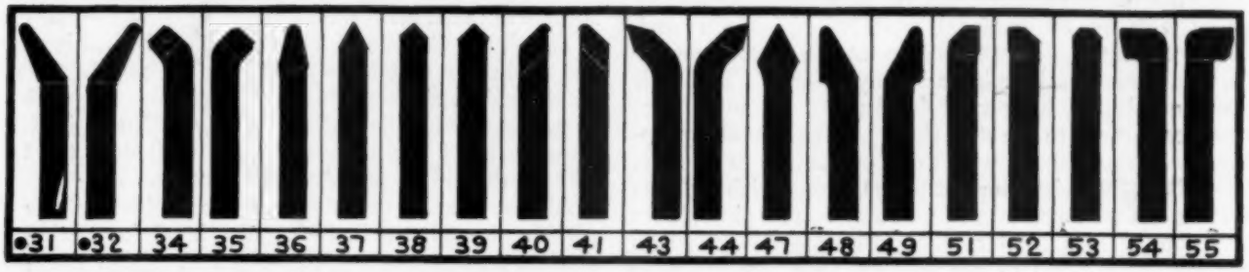
Because of the high heat required in treating high cobalt steels, the decarbonized surface must be thoroughly ground off; otherwise results will be no better than that from commercial high-speed steel. In grinding, remove from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch in depth off the cutting profile and use a quick cutting (wet process) abrasive wheel. Do not under any circumstances force the tool against the wheel so as to draw the color, as this is likely to set up checks on the surface of the tool to its detriment. If dry grinding is employed, care must be taken never to dip the tool in water when colored or hot. Rapid cooling causes cracking or checking of the tool. Never grind too forcibly. Never rough grind dry large amounts after hardening.

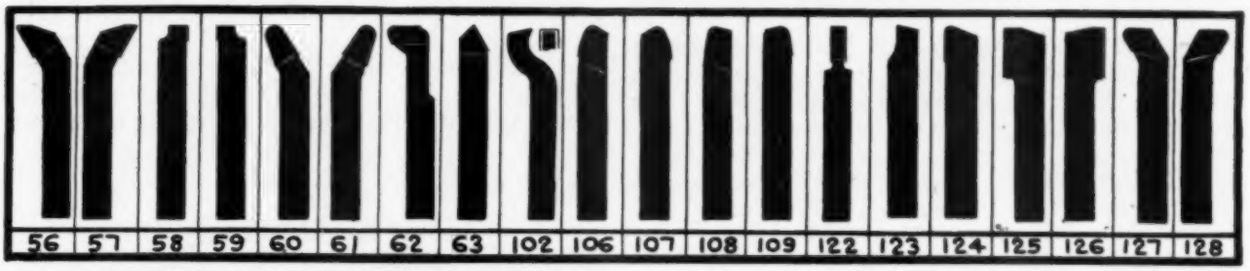
Modern competition on manufactured products demands the greatest accuracy at the lowest cost. Each year, machine tools are designed to give greater driving power at increased speeds and feeds. Any machine, however, is only as good as the tools which it operates, and its productive capacity is controlled by their ability. It is only natural then that there should be a demand for tools which have sufficient strength to maintain accuracy under the increased strain.

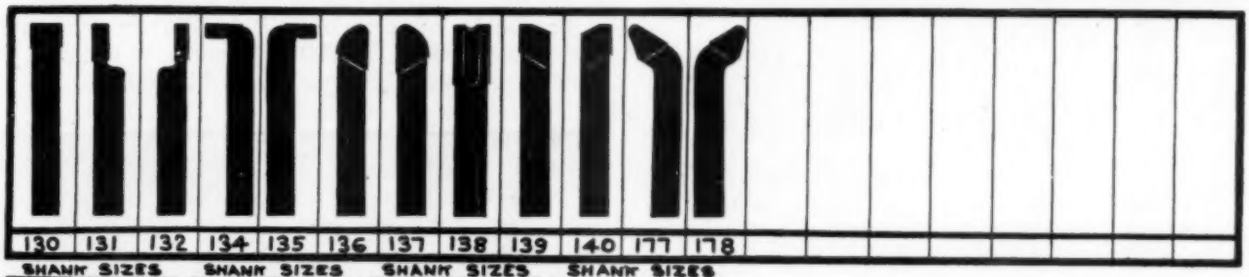
High cobalt steels have met these requirements. Toughness is combined with hardness in this material and permits a wide range of application, which results in tool economy. Another angle of economy in tools is the tipping of carbon shank material with high cobalt steel. This process of tool manufacture reduces the cost from 30 to 50 per cent, depending on the size of tools required. In general, forged tools are expensive. By the tipping process, it is possible to eliminate much of the human

## STANDARD FORGED TOOLS




**SHANK SIZES — LATHE-SHAPER-PLANER**

| Size | Shank Length | | |
|---|---|---|---|
| ¼ x ¼ | 5 | 4 | |
| ⅜ x ⅜ | 6 | 5 | |
| ½ x ½ | 7 | 6 | |
| ¾ x ¾ | 8 | 6 | |
| ¾ x 1½ | 10 | 8 | 6 |
| 1 x 1½ | 12 | 10 | 8 |

| Size | Shank Length | | |
|---|---|---|---|
| 1 x 2 | 20 | 16 | 12 |
| 1¼ x 2¼ | 22 | 18 | 14 |
| 1½ x 2½ | 24 | 20 | 16 |
| ¾ x 1 | 5 | 6 | 7 |
| ¾ x 2 | 20 | 16 | 12 |

**SHANK SIZES — BORING MILL**

| Size | Shank Length | | |
|---|---|---|---|
| ¼ x ¼ | 2½ | | |
| ⅜ x ⅜ | 3 | | |
| ½ x ½ | 4 | | |
| ¾ x ¾ | 4½ | | |
| ¾ x ¾ | 5 | | |
| 1 x 1 | 7 | 5 | |

| Size | Shank Length | | |
|---|---|---|---|
| 1¼ x 1¼ | 9 | 7 | 5 |
| 1½ x 1½ | 12 | 9 | 7 |
| 1½ x 1½ | 16 | 12 | 9 |
| 2 x 2 | 20 | 16 | 12 |

A wide variety of tool shapes is needed by most shops. Unless standardization is employed, each operator is likely to accumulate his own set

## DESCRIPTION OF FORGED TOOL SHAPES

| | |
|---|---|
| 1 | Straight Threading |
| 2 | R.H. 45° Threading |
| 3 | R.H. Offset Threading |
| 4 | Straight Convex Forming |
| 5 | Straight Concave Forming |
| 6 | L.H. Cutoff |
| 7 | R.H. Cutoff |
| 10 | Round Nose Boring |
| 11 | Internal Threading |
| 13 | R.H. Side Tool |
| 14 | L.H. Side Tool |
| 15 | L.H. Outside 45° Chamfer |
| 16 | R.H. Outside 45° Chamfer |
| 17 | R.H. Inside 45° Chamfer |
| 18 | L.H. Outside 45° Chamfer |
| 21 | 60° R.H. Diamond Point |
| 22 | 60° L.H. Diamond Point |
| 26 | 30° Offset L.H. Round Nose |
| 27 | 30° Offset R.H. Round Nose |
| 28 | Copper Tool |
| • 31 | 45° 30° 20° 8° L.H. Copper |
| • 32 | 45° 30° 20° 8° R.H. Copper |
| 34 | R.H. 45° Roughing |
| 35 | L.H. 45° Roughing |
| 36 | Commutator Tool |
| 37 | 70° Commutator Tool |
| 38 | 45° R.H. Shaper Tool |
| 39 | 45° L.H. Shaper Tool |
| 40 | 36° R.H. Roughing Tool |
| 41 | 36° L.H. Roughing Tool |
| 43 | 60° Point Offset L.H. |
| 44 | 60° Point Offset R.H. |
| 47 | Centering Tool |
| 48 | Side & Chamfering Tool |
| 49 | Side & Chamfering Tool |
| 51 | Finish Fit & Chamfering Tool |
| 52 | Finish Fit & Chamfering Tool |
| 53 | Double Chamfering Tool |
| 54 | R.H. Boring Mill Tool |
| 55 | L.H. Boring Mill Tool |
| 56 | R.H. Boring Mill Tool |
| 57 | L.H. Boring Mill Tool |
| 58 | R.H. Corner Radius |
| 59 | L.H. Corner Radius |
| 60 | R.H. Offset Boring |
| 61 | L.H. Offset Boring |
| 62 | Rough Boring |
| 63 | 45° & 30° Double Fit Chamfering |
| 102 | Square Goose Neck |
| 106 | R.H. Round Nose Roughing |
| 107 | L.H. Round Nose Roughing |
| 108 | R.H. Roughing |
| 109 | L.H. Roughing |
| 122 | Straight Cutoff |
| 123 | R.H. Crowning Tool |
| 124 | (Lo Swing) Roughing Tool |
| 125 | R.H. Finishing |
| 126 | L.H. Finishing |
| 127 | L.H. Boring Tool |
| 128 | R.H. Boring Tool |
| 130 | Square Nose Finishing |
| 131 | R.H. Offset Cutoff |
| 132 | L.H. Offset Cutoff |
| 134 | Inside Square Nose |
| 135 | Outside Square Nose |
| 136 | R.H. Roughing (Long Radius) |
| 137 | L.H. Roughing (Long Radius) |
| 138 | R. & L.H. Side Tool |
| 139 | R.H. Finishing |
| 140 | L.H. Finishing |
| 177 | L.H. Offset Boring Tool |
| 178 | R.H. Offset Boring Tool |

• SPECIFY THE ANGLE DESIRED

THE LIGHT LINE ON TOOL REPRESENTS THE CUTTING EDGE OF THE PROFILE

element which sometimes is the cause of the tools failing.

In large shops where many forged tools are used, operators accumulate thousands of tools, resulting in large tool steel investment. Incentive production encourages this accumulation because an operator upon receiving a new job, often is compelled to grind a tool to machine the job. If this work becomes standard repeating from time to time, he holds the tool in this shape. This condition in a large shop repeats itself many times. Therefore, by organizing a forged tool control by permitting the operator to have a large selection of tool shapes and sizes, there is less tendency to harbor tools.

To determine the durability of high cobalt steel compared with the conventional grade of high-speed steel, a test was made. Represented were the most reputable manufacturers of brands nationally known. The tools used in this test were type 40, 1x2x12 in. long. The tips were brazed to the steel shanks. The chemical properties of the shank were 50 to 65 carbon, 60 to 90 mm., 0.04 phos., 0.20 si. The test pieces upon which the cuts were taken were unannealed axle steel. The pieces were 4 ft. long, 7 in. diameter. This diameter was gradually reduced by $\frac{1}{4}$ depth of cut to 3 in. No coolants were used in this test.

A feed of $\frac{1}{16}$ and depth of cut $\frac{1}{4}$ was held constant throughout the test. The cutting speed in feet per min. was 75 ft. Each tool was resharpened and tried three different times. Composition of the test pieces:

| | |
|---|---|
| Manganese ..... | not over 0.70 per cent |
| Phosphorous ..... | not over 0.05 per cent |
| Sulphur ..... | not over 0.06 per cent |
| Carbon ..... | 0.35 to 0.50 |

Physical properties of the material:

| | |
|---|---|
| Tensile strength | 75,000 to 90,000 lb. per sq.in. |
| Brinell hardness | 160 |

The commercial grade of high-speed steel cutting time was 12.9 min., removing 181 cu.in. of metal. High cobalt or super high-speed steel cutting time was 15.9 min., removing 224 cu. in.

A test to determine the cutting and clearance angles on high cobalt steels proved that this material must not have more than 6 deg. side clearance and approximately 16 to 18 deg. cutting angle.

## Importance of Smooth Bearings
### *Discussion*

JOHN R. GODFREY

MR. RAEBURN'S idea of the super-fine knurl for finishing crankshaft bearings (*AM*—Vol. 75, page 377) is interesting but not likely to be adopted in this country. For, contrary to his opinion against lapping, this method seems to be growing in favor. Hardly a bearing is now scraped, diagonally or otherwise, even the Rolls Royce in this country depending on mechanical methods to secure the most accurate surfaces, while the idea of minute oil pockets in scraped surfaces seems to have been discarded.

It is generally agreed that the depth of the grinding cut should be reduced as the pin approaches its proper size, this being usual practice in some shops. While many shops still have much to learn about lapping, the prejudices against it seem to be dying out. A large proportion of piston pins are now lapped, and the process seems to be making its way into more general practice.

## Quick Heat-Treating Tests

A. H. SUYDAM

COMPLICATED laboratory analysis serves its purpose in general control of heat-treating, but in the shop the chief question is whether or not the particular batch just quenched is of the proper hardness and toughness. A manufacturer of ball and roller bearings gets the answer in a few seconds by testing to destruction balls or rollers by the simple expedient of "socking" them with a dropped weight from a fixed height. If they survive the test, all is well.

The device consists of a cup in which the ball is placed and a plunger that loosely fits it. The weight falls 15 ft. through a chute made of 4-in. pipe and is retrieved by a rope and pulley at the ceiling. Simple in form, cheap to build, definitely comparative, it does the trick without the aid of precision instruments.

Almost next to this drop tester and just outside the window are a hot acid bath and a hood for testing the product further along in manufacture. After the rough grinding operation each ball or roller is given an acid etch to reveal faults in material and structure and hair-line cracks caused either by improper hardening or by grinding too fast. The etch marks are completely removed in the finish grinding and lapping operations.

## Along the Assembly Line

SELF-TAPPING screws play an important part in assembly of certain Edison Electric appliances. Edison uses about 1,090,000 of these screws annually, the number per assembly varying from 4 to 108.

# Working With High-Chrome Steels

**Machining, press-working, forging, casting, welding—there seem to be no glaring difficulties in any operation on "stainless." As is usual, the pioneer is profiting by the timidity of many of his fellow manufacturers**

CHESTER B. LORD
*Associate Editor*

IT IS difficult, if not impossible, to write a straightforward account of process development in the field of the high-chrome alloy steels—for two reasons. First, there have been many developments and new mixtures, each of which is adapted or confined to its own particular field. The next reason arises out of the differences in practice, and consequently of opinion, in different lines of manufacture or even in the same line. One man will say that a given operation of casting, welding or machining is impossible; the next man will dispute the assertion and say it is easy. Further investigation often results in reconciling the different opinions or giving a sound basis for the differences. The fact that one firm may furnish castings or sheet for chemical purposes, while another furnishes them for rust prevention or ornamental purposes is one cause for the differences of opinion. That novelty prices are being secured for the metal in fabricated form, and for work done upon it, is still another reason, the idea being to keep the timid out.

## Mixtures

The "stainless" quality in iron and steel is obtained commercially through chromium. The addition of more than 11 per cent chromium is necessary to provide the stainless quality even in pure iron. Above that, it is necessary to keep the proportion of chromium at least eighteen times as great as the carbon content, because the two combine in that proportion and the alloy is not rust resistant unless there is an excess of chromium.

Nickel has some of the properties of chromium, but not nearly to the same extent. In plants where bar stock is not kept under cover, the experienced eye can always pick out nickel bars by the relative smoothness of their surfaces. Regardless of how long the bars have been exposed, the surface does not pit like ordinary carbon steel. This quality in chrome-nickel steel, however, is incidental. The main purpose of the nickel is to improve the physical and mechanical qualities of the metal, while the original purpose of the chrome was to resist acid.

The mixtures of chromium alloys cover a wide field. Some of them contain nickel, some do not. For hot-acid-resisting qualities the Duriron Co., of Dayton, Ohio, has developed a "21-20" nickel-chromium alloy with a maximum of 0.9 per cent carbon. It will be noted that this is in proportion of over 200 chromium to 1 of carbon. If we credit nickel with 25 per cent of the resistant qualities that chromium has, the proportion becomes over 270 to 1. The relation between carbon and chromium is important.

Another alloy, comparable to this "21-20" mixture, is the U. S. Steel "27" used for the same purposes. The proportions of chromium to carbon are 270 to 1, no nickel being used. Such a mixture work-hardens easily; the nickel makes for ductility and machinability.

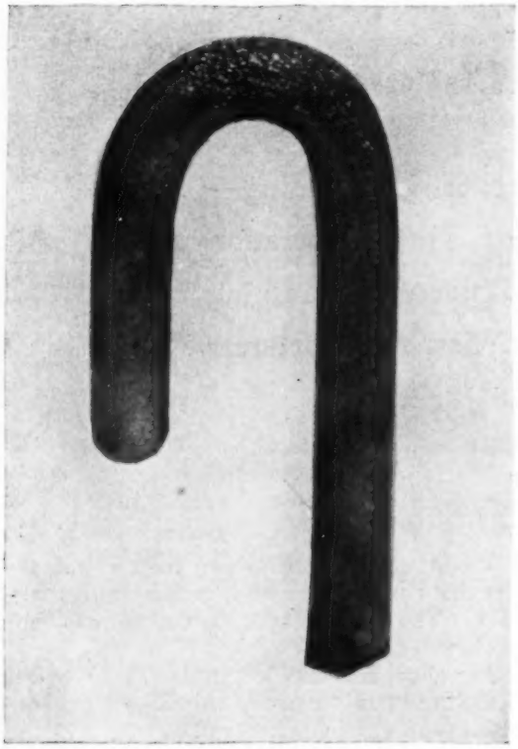
The "21-20" and the "27" mixtures are acid resistant to most of the commercial acids, except chlorine, muriatic and some solutions of sulphuric acid. Under specific conditions, "21-20" castings will resist concentrations of sulphuric acids except one of 77.7 per cent.

A table of tests shows that cold sulphuric acid of 77.7 per cent concentration has no effect, while the maximum effect is at 205 deg. F. The penetration of the above concentration would be 0.705 in. per year. On either side of this, a 60 per cent concentration would penetrate only 0.097 in. and a 93 per cent one, only 0.007 in. This seemed like an error and I hastened to check it up. I was assured that a large number of tests bore out this statement. It is unfortunate but true that stainless steel cannot be used with hot 77.7 per cent sulphuric acid.

## Machining

Like other branches of high-chrome steel practice, opinions differ as to the ease or difficulty of machining. My own experience in machining has been limited to drilling, milling and turning turbine blades, and while it was more costly than machining cold-rolled steel it was by no means difficult. There are usually two reasons for piling up difficulties in the way of manufacturing technique: one is to discourage others from going into it; the other, more innocent, is lack of knowledge or facilities. There are no really difficult jobs in industry, aside from those that require manual skill, if they are sufficiently divided and properly planned and tooled. The cure is always: less feed and speed, or added operations.

The essentials of production machining seem to be about the same as for medium-carbon steel, as far as feed and speeds are concerned. Both the side clearance and top rake of lathe tools should be increased. Some recommend a rake of 15 deg. Sharpness of tools is very essential, and they must not be allowed to dwell without cutting. This latter is equally true of milling, drilling



**A polished high-chrome steel rod after immersion in sulphuric acid. The rod showed no signs of disintegration until it was bent**

and turning. The coolant may be the ordinary soluble oil, or in difficult cases lard oil and sulphur. Sulphur in quantities is fatal to any kind of steel; its effect is to weaken. Used in a lubricant, it has the property of changing the cutting quality of the steel. Just what takes place when it is used thus is problematical. It is inconceivable that it should penetrate and embrittle the steel. Some chemists claim that the effect is more imaginary than real and that the sulphur merely affects the solubility of the oil, but you can't convince a screw machine foreman that it does not have a decided and real effect. Whatever the effect, it seems to have even more active effect on the stainless steels.

It is fair to say that the milling of the standard 18:8 mixture should cost about 10 per cent more than for ordinary soft steel, or about the same as Dural or high-carbon steel. On some roughing cuts this will, or may, be very much higher, because where the cut is eccentric and does not get entirely under the skin, workhardening is likely to take place. For this same reason the entering edge of a cut is rougher than the leaving edge.

On other machining operations, such as drilling, broaching and planing, the cost increase is negligible.

## Pressworking

High-chrome steel bids fair to revolutionize the kitchen, especially the hotel and hospital kitchen and the ship's galley. Aluminum and copper are beautiful metals, but they either require considerable labor to keep "shiny" or else dent easily. With some modifications from usual practice, which are hereafter noted, high-chrome steel is spun and deep drawn as readily as ordinary steel.

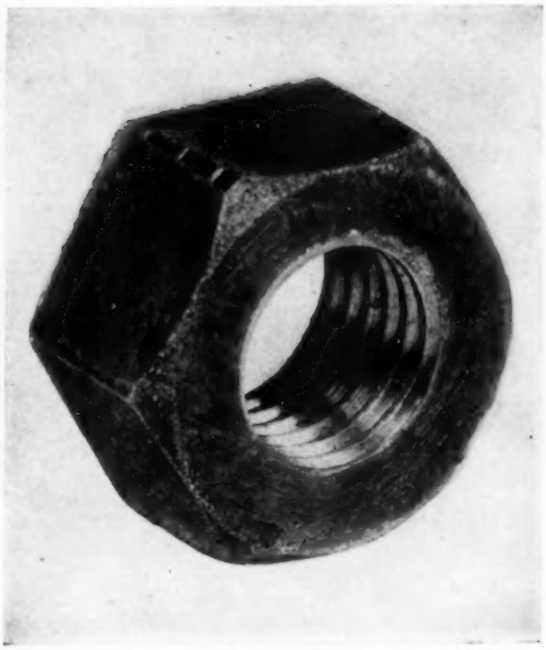
Drawing one kind of steel is comparable only with drawing another kind of steel, and as cooking utensils are made of several materials, direct comparisons are difficult. In general the differences between chrome and ordinary open hearth are as follows:

Lubricant, same. Power necessary, 25 per cent more. Proportions of diameter to depth, same. Construction of dies, one more operation, generally. Cutting die lasts only half as long. Breakage, slightly more. Annealing, necessary between each operation. Sometimes to 1,950 deg. F., at other times to 1,350 deg. F. depending upon the work done. Spinning requires five times as long. Spun parts, if left standing overnight without annealing, will often crack in the next operation. The metal is self-hardening in a measure, like Duralumin, and spinning strains are likely to start cracks. The same is true of drawn work if the drawing is severe or the part ironed out.

Before annealing, the parts are scoured with beach sand to remove any traces of the lubricant. Scale formed by failure to do this is very abrasive and cuts the dies rapidly. After annealing, the parts are pickled in a 15 per cent solution of hydrochloric or muriatic acid and then in a 10 per cent solution of nitric acid. After removal from the nitric bath they are again scoured with beach sand. This scouring is important. Sulphuric acid should not be used because it is fatal to rolled sheet, as will be explained later.

High-chrome steels require about ten times as much labor to polish as ordinary steel. Usually, on high-chrome sheet metal, there are three grindings, using No. 60, 120, and 200 grain abrasives. Opinions differ as to whether ordinary polishing rouge is harmful or not; some claim that iron oxide should not be used. Others use it without question. The difference of opinion probably depends upon the use to which the part is put. Personally I am inclined to believe that it should not be used on thin metal that is not to be washed frequently. The "binder" of high-chrome steel sheet is iron carbide, the sulphur

**One half of a pair of tweezers cold forged in a punch press. The flash is 0.031 in. thick**



**A cast nut with thread cut in a rough, cored hole**

in rouge attacks this and might disintegrate a thin sheet in due time. Sulphur in any form or quantity is fatal.

## Forging

High-chrome steels roll and forge about like the high-carbon or nickel steels having the same percentages of carbon.

Rolling appears to break down the structure in some way and instead of a granular or crystalline structure, sheet appears to have a flaky or fibrous structure with slag between, something like wrought iron. This same structure is seen in photomicrographs of low-carbon sheet, but in high-chrome steel it is independent of the carbon content and is much more apparent under certain conditions.

The binding substance between the flakes or fibers of this steel is iron carbide. If a piece of this sheet is immersed in even a weak bath of sulphuric acid this binder of iron carbide dissolves and without loss of weight or bulk, the sheet becomes "rotten" and of no use whatever. When dropped, the piece sounds and acts like a piece of sheet lead. It is this feature of not losing weight or bulk that is likely to be misleading to the one who is not very observant. A polished rod, for instance, may be immersed in a bath of sulphuric acid and upon removal its appearance or weight will not have changed. It is still polished, even.

The verdict in such a case is likely to be that it is not attacked by sulphuric acid, but if we attempt to bend the rod, the outside crumbles.

The following experience is illustrative of the attitude of different shops toward the workability of "stainless" steel. Perhaps they desire to scare people away from its fabrication. I called at a certain nut and bolt factory. The man in charge informed me that there were so many tricks in heading bolts and cutting threads that they did not feel justified in giving out any information regarding the methods they used. Their employees had developed most of the methods and they did not consider it fair to reveal them. I visited another shop making the same product and the superintendent told me that he had made no changes whatever, in either his equipment or methods. He did modify that statement later, however, by saying that he used slightly less speed in threading. Bolts and nuts in the storeroom did not look different from any ordinary bolts and nuts.

There is no change of practice necessary in other forms of forging either hot or cold. Cold forging leaves a good impression and thin sections can be forged.

## Casting

Differences of opinion exist as to foundry practice, but these, like the difference found elsewhere can be reconciled by taking into consideration the use to which the castings are to be put. One foundry I visited used resistance-type electric furnaces with crucibles. Another had thrown out nearly new resistance furnaces and installed the induction type lined with silica brick, claiming that where carbon electrodes are used the carbon content of the mixture could not be controlled within the limits demanded by good practice.

The facts of the matter are that the foundry using the resistance type of furnace usually furnishes castings for ornamental and atmospheric-resistance purposes. A variation of a few points in the carbon is of little consequence, provided the foundry maintains the ratio of 18 or more per cent of chromium to every 1 per cent of carbon, plus the 11 per cent that is necessary in even pure iron. On the other hand, where the metal is used for acid-resisting receptacles, the carbon must not only remain low but as constant as possible. Standard 18:8 steel made by the U. S. Steel Corp. has an allowable carbon variation of 0.05 to 0.15 per cent. This steel is recommended by them for all the arts. It will weld, draw and forge. The same steel made by the Duriron Co. contains a maximum of 0.07 per cent carbon. As iron carbide is the vulnerable point in chrome alloys, the necessity of more closely controlling the carbon is apparent for acid-resistance purposes. At least one large steel firm is using its Bessemer converters for making high-chrome steel. This method allows of reducing the carbon to a very low point.

For casting, the metal is heated to around 3,100 deg. F. One foundry heats to 3,150 deg. F., the superintendent claiming that the metal cools quickly and that the temperature of the metal is lowered 100 deg. during the flow. The actual pouring temperature, he believes, is around 2,900 deg. F. Practice differs in molding technique also, the one making ornamental castings uses dry sand molds of silica faced with French sand; the other one making industrial and acid-resisting castings uses both green and dry synthetic sand molds faced with a special preparation that will withstand the high pouring temperature and still be self-cleaning. It is generally agreed among foundrymen that when using green sand a larger percentage of new sand is necessary than with ordinary steel castings.

Core practice differs from ordinary steel practice in that the cores must be made so that they will collapse readily. Chrome alloys set quickly and cool rapidly. The cores must be soft enough to give under heat, but yet firm enough to stand the wash of pouring.

Some castings require annealing, others do not. Industrial castings that are to be machined are generally normalized at 2,100 deg. F. for 1 hour per inch of the heaviest cross-section. Other foundrymen think that 1,800 deg. F. is high enough.

I was somewhat surprised to find one manufacturer

using cast nuts for sizes above ¾ in. The cored hole was tapped without drilling and the thread was good. I had to be informed that they were cast nuts. I would not have noticed it otherwise.

Welding high-chrome steel is being successfully done by many plants. Some of the commercial welders who were early in the field conjured up all kinds of difficulties. They were interested in doing this because they had a good thing and did not want it spoiled by too much competition. The actual labor and material cost per foot of weld on thin sheet should average from 40 to 70 cents. Some commercial welders are charging from $4.00 to $6.00 per foot on some classes of work. Such practices tend to restrict the use of sheet, but this situation will eventually iron itself out. An authoritative article on welding stainless steel appeared in *AM*—Vol. 73. p. 485.

The above remarks apply to oxide-resisting steels only. For acid resistance there is still a question whether welding can be used or not. Here again opinions differ. One manufacturer claims that he has replaced almost every tank that he has sold. The tanks do not leak nor do they fail at the weld, but they do fail a short distance from the weld on both sides. This strained section is not acid resistant, and the condition of "rottenness" without loss of bulk or weight sets in and the tank fails.

The advent of high-chrome steel has given rise to an entirely new type of business, a service that corresponds somewhat to the production department in a plant. For instance, high-chrome steel cable cannot be purchased in the open market, but a certain company in New York purchases the wire from the mill, delivers it to the wire rope maker and has it made into cable to specifications. They will purchase rod parts at one plant, forgings at another, and have turnbuckles or other parts made up at another.

# Wage Incentive for Nitriding

R. W. GRAY

ALTHOUGH nitriding parts, on a commercial basis, is a comparatively new process of heat treating molybdenum-aluminum steel to obtain a hard surface, a just, accurate and flexible wage incentive can be applied when the specifications have been determined, and a time study made.

The time allowance per piece must be flexible enough to permit its use with a variety of weights, sizes and shapes of parts. It must be complete and detailed to show the time required for handling each piece; preparation of the part before nitriding; preparation of the furnace; furnace attention time per hour; and the conditioning of the furnace at the end of the heat. Furnace capacity must be definitely known. The number of parts of a given size and shape that can be placed in the furnace at one time must also be determined. Calculations for the time allowed for nitriding each part should be based upon the maximum number of that type of part that can be nitrided at one time. If there are not enough of one type of part to make up a capacity charge, there will be room for a given number of other parts that have also been calculated on the basis of the maximum number that could be charged at one time.

Where:

$h$ = Handling time for placing the part in and removing the part from the furnace.
$c$ = Furnace attention time per hour.
$t$ = Duration of the heat in hours.
$f$ = Time required to prepare the furnace for the heat and to condition the furnace after the heat.
$s$ = Maximum number of parts that can be charged in one furnace at one time.
$n$ = Time allowed per piece.

Then

$$h + \frac{c\,(t) + f}{s} = n$$

Take, for example, a forging made from ten inches of No. 4588 nitriding steel 4 in. square. A definite sequence of operations and their corresponding time allowances are established upon receipt of the order and before manufacture of the part is begun. In establishing the allowed time for nitriding each piece, it is known that the process specification calls for a 25-hr. heat; that the furnace attention time is 0.22 hr. per hr.; that the preparation and conditioning of the furnace requires 6.02 hr.; that the total handling and preparation time of the part is 0.03 hr.; and that four layers of ten forgings each, or a total of forty forgings, can be placed in the furnace at one time. Then solving the equation for $n$:

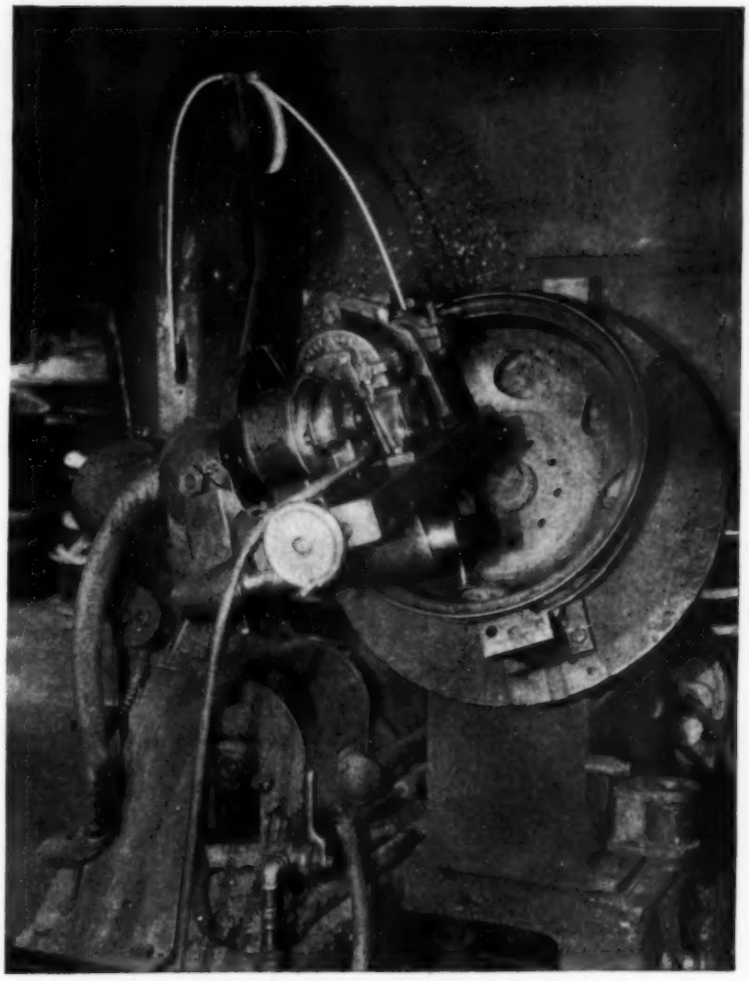
$$.30 + \frac{.22\ (25.00)\ +\ 6.02}{40} = n$$

$.30 + .288 = 0.588$ hr., the time allowed per piece.

This method eliminates the necessity of depending upon parts of an average size or weight for the establishment of equitable time values. It also indicates any attempt to operate the furnaces at less than capacity loads.

Part-handling time is dependent upon both the weight and shape of the part. Nitriding time is entirely dependent upon the number of parts that can be charged at one time and the length of time required for nitriding. All calculations are based upon the fact that a battery of nitriding furnaces is available, or that other work can be performed between the periods of time allowed per hour for furnace attention. When other work is not available, or if only one nitriding furnace is used, the determination of the furnace attention time per hour $c$ is unnecessary and the total duration of the heat $t$ in hours would be used.

For convenience of application, part handling time $h$, a variable, may be tabulated. Furnace attention time $c$ and the time required for the preparation of the furnace and conditioning $f$ are constants. Duration of the heat $t$ is dependent upon the process specification and is a variable. The number of parts of one kind that can be charged $s$ is variable and can be tabulated or plotted dependent upon the variety of parts nitrided. By reducing the data to a compact form, time values may be accurately determined in minimum time, a just wage incentive is offered the operators and an accurate cost per piece may be established.



Metallic arc-welding of the Budd dual wheel

# Welding Automobile Wheels

C. L. EKSERGIAN

*Chief Engineer,*
*Budd Wheel Company*

**A critical survey of flash, butt, projection, spot, and arc automatic welding in the manufacture of steel automobile wheels**

WELDING has ceased to be an art; the human equation has been eliminated. In place of skilled artisans, we have highly mechanized processes. The variables that enter, such as time, pressure, amperage, voltage, may all be automatically controlled. No longer need we rely upon the ability and judgment of the individual welder; his opinion and his deftness are now embodied in machines. Their performance is the same irrespective of the personal characteristics of the operator.

The element of judgment is present only in the initial setting of the machine. From that time on, the machine carries out implicity its instructions—instructions which may be specifically specified and accordingly specifically realized. Instead of being subjected to an indiscriminate use, judgment is confined to a selected mind qualified by training and guided by experiment and test. Again it is called upon only once for a given job and at a time when freedom of study is possible and can be advantageously employed. Errors and inconsistencies attending repetition are accordingly avoided.

The results of this era of mechanized welding are: dependability, speed and lower costs.

In no other process has mechanization been so essential to dependabiity as in welding. By dependability is meant both quality and consistency. By virtue of selected judgment, unimpaired by being introduced (quite properly) at the outset of the program rather than throughout its execution, conditions requisite to quality can best be definitely established. Again, with the machine, as in all regulated systems, these conditions can now be *definitely realized* and continually repeated *without change*. Hence, quality and consistency, and therefore, dependability may now be relied upon to be present.

The expected production benefits in speed and lower costs, resulting from mechanization, are all the more present in welding. Not only has time been reduced by mechanizing otherwise manual welding operations, but also great savings have been made by advantageously resorting to operations peculiarly and many times only suitable to machine welding. For example, manual arc welding may be replaced with machine are welding with considerable saving in man time and some in operation time. However, if, say flash or spud welding were substituted, it could easily be possible that greater savings in both operation and man time would follow.

Apart from the reduction in costs which usually attends increase in speed, unit labor costs are considerably reduced due to the substitution of unskilled operators for skilled. This is particularly true in welding, since considerable proficiency and skill is required in manual welding as in contrast to the simple mechanical operation in machine welding.

This review of the status of welding has been purposely presented in order to stress the turning point between the old form of welding and modern methods. Although modern machine welding has been employed for some

Rim butt- and flash-welded prior to removal of flash

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Two-piece hub forging butt-welded. The strip section is that taken from a Budd disk wheel welded as shown, and is a typical fatigue test specimen

•

Early type wire wheel hub shell in which the inner and outer plates were arc-welded together

•

years, there still exists the stigma of the old tradition of welding. Welding is no longer confined to repair jobs and special samples, and does not necessarily require highly skilled artisans to obtain a reliable weld.

It is only with a full realization of the scope of modern machine welding that its advantages as a manufacturing process can be appreciated and advantageously utilized. The fact that dependability, speed and low costs are found in modern welding makes it a genuine manufacturing process.

As a process in the manufacture of automobile wheels, welding has made considerable gain. However, with the exception of one wire wheel in which the spokes are welded, it has only been relatively recently that welding has been utilized to any extent. The fact that welding has proven itself to be perfectly dependable even though subjected to the high loads carried by wheels has won the confidence of the dubious. This fact, together with the manufacturing economies effected, has justified its pioneers and will serve, no doubt, to increase its growth.

In view of recent developments, practically all of the standard forms of welding have been or are being employed in the various parts of wheels. The common forms of welding found are: butt and flash welding, projection and spot welding and automatic and mechanical arc welding employing both the metallic rod and carbon rod. A brief description follows of the characteristics and features singular to each particular type of welding as well as its employment in the wheel.

## Flash and Butt Welding

Perhaps the most common and prolific form of welding found in wheel practice is either the flash or butt weld. Practically all rims and felloe bands employ either the flash or butt weld subsequent to hooping or circling. This practice has been in effect for a great number of years so that welding of this character may be regarded as being quite orthodox. Although the terms flash and butt welding are often interchanged, actually these two forms of welding are quite distinct in characteristics and function of operation. It so happens, however, that in many instances the actual welding operation is a compromise, so to speak, between a true butt and a true flash weld. Accordingly, for this form of welding either term is equally appropriate.

The flash weld, strictly speaking, is one in which the two edges of the work are brought together so that they either lie within a few thousandths of each other or barely touch. At this moment the electric circuit is closed causing the current to arc across the two ends. This condition offers maximum resistance and therefore maximum heat. The result is that the edges burn very rapidly and would "blow" away were it not for the fact that simultaneously the work is brought together, thereby presenting new material to the heated zone. In the meantime, due to the interval which exists while the circuit is on, sufficient time is present to permit the necessary penetration of heat so that at the time of "forging" or "push-up" the material is in a properly heated condition. The motion during flashing is so timed as to compensate for the material lost in flash. The final operation, as already suggested, is one of a forging nature in which the hot metal ends are pressed together and thereby welded. This final operation usually takes place with the current off. Hence it is seen that flash welding is particularly suitable to work in which thin edges are to be united as no large pressures are imposed on the walls.

In butt welding, on the contrary, much higher pressures attend so that usually butt welding is employed in heavier work. In butt welding a definite metal-to-metal contact under pressure obtains at the outset. Accordingly, much less metal is flashed off during the electrical heating, and a cleaner weld results. On the other hand, heavier pressures are required and considerably greater electrical requirements are necessary. The reason for this is that the resistance is considerably less, and consequently a greater electric input must be furnished to supply the necessary heating.

From the above it is clearly evident that the welding operation may lie half way between that of a true butt weld and a true flash weld, depending upon the manner of operation. Generally speaking, however, the machine employed for flash welding is different in operation than that for butt welding. In flash welding the work is fixed to the respective dies and the dies are brought

together under a predetermined motion. In butt welding the work may be held apart by its own edges or ends and pressed together by the welding dies, which in turn may be actuated under pressure rather than a predetermined motion.

This particular differentiation between butt welding and flash welding has been definitely appreciated in the welding of the Budd artillery steel wheel. It serves as a splendid illustration of the pros and cons of butt and flash welding. This wheel perhaps serves as a pioneer introduction of flash welding as employed in automotive wheels over and above the orthodox rim welding. Up to this time flash welding has not been employed in the wheel structure, the artillery steel wheel marking its invasion in wheel welding. However, butt welding has been used to some extent in the manufacture of forged hubs—usually of double flange construction. The singular advantage of welding in this instance lies in the ability of making two simple single-flanged hubs and adjoining them by welding.

## Projection and Spot Welding

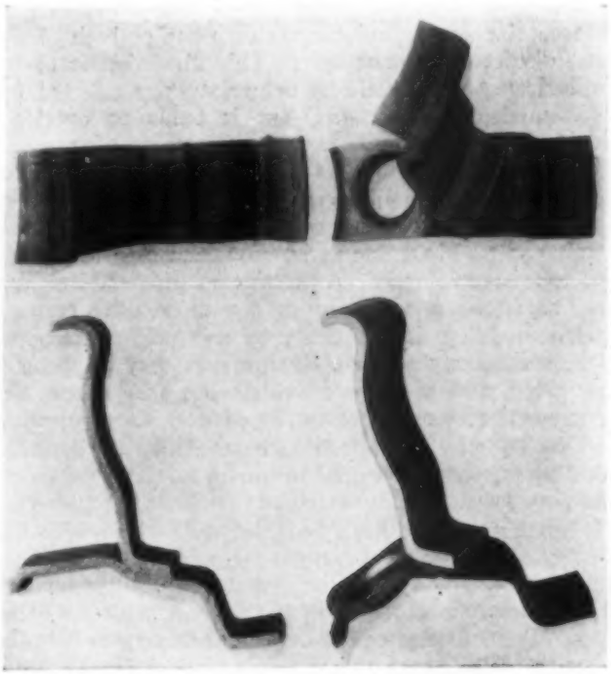
The projection and spot weld has been little used, if at all, in automobile wheels until recently. As far as the writer knows, the projection weld was employed for the first time last year in the Budd two-piece hub shell. It is quite possible that from time to time spot welding has been employed on the attachment of minor parts, such as balance weights and so on. Although spot welding has been used to some extent in the attachment of the rim to the disk, no appreciable usage has been made of this form of welding. It is felt, however, that both projection and spot welding offer many opportunities in wheel construction, and more advantage will henceforth be taken of this form of attachment.

The projection and spot welds are virtually the same type of weld, but they are obtained in different manners. It is in this connection that the advantages of one may outweigh those of the other. The simple spot weld is made by placing the two surfaces to be welded between the welding electrodes. The characteristic difference between it and the flash or arc weld is that two surfaces are locally welded as against two edges being continually welded. The actual welding operation is not unlike that of the butt weld as the electrodes are brought against the work under a predetermined pressure. This initial pressure is critical for given conditions of current and thickness of material to be welded, as well as analysis. The minimum pressure is defined by that which will not permit of burning. The maximum pressure is defined by that which will afford sufficient resistance to obtain necessary heating with minimum current. The operation of the weld simulates that of butt welding. After the initial pressure has been imposed, current is passed through the work from one electrode to the other, heating the local area between. Directly following, a push-up or higher pressure is imposed to insure the success of the necessary forging operation. In actual practice many times, gradual pressure build-up is found sufficient during the interval of heating, which accomplishes practically the same results as the theoretical cycle outlined.

The advantage of spot welding over projection welding lies in the elimination of a stamping operation to form the projections in the cases where an added operation would be so required. (Many times this operation can be made simultaneously with some other attending operation.) Another definite advantage of the spot weld over the projection weld lies in the fact that the work does not undergo a deformation. This is of singular consequence in the welding of the disk to the rim. In this case a projection weld would be difficult to employ as the O.D. dimensions of the disk vary as the projections are pushed down.

The disadvantage of spot welding is greater lack of reliability attending excessive die wear. In order to obtain a reliable weld, particularly on thinner materials, the diameter of the die point should be kept a minimum. This is necessary to insure a direct and concentrated and

**Budd wire wheel hub shell as redesigned to accommodate projection weld. Note manner of test to pull shell apart, and how the welded material has held at the projections**



**Section of Budd projection-welded hub shell. Here the section is subjected to a twist test to determine degree of ductility of weld**

accordingly efficient path of current through the work. Under repeated operation these points "mushroom" and then, becoming larger, lose their efficiency and finally begin making unreliable welds. Hence it is necessary to maintain vigilant attention of the die points. The projection weld, on the other hand, successfully copes with this inherent shortcoming. In the projection weld a projection is raised on one of the surfaces to be welded. Otherwise the operation is similar to that of the spot weld, except that different conditions of current, time and pressure are probably found necessary to obtain optimum welds. By virtue of the projection it is seen that a new point is presented for every new weld, so that the element of die wear is less consequential. Moreover, since the localized current path is regulated by the projection rather than by the die point, larger die points may be utilized. Accordingly, less wear and deterioration, therefore less attention and maintenance, are required in the projection weld. This particular feature cannot be overemphasized, for the shortcomings of the spot weld in this direction have resulted, in many cases, in excluding its use. Again, due to the fact that a point contact is always maintained in the projection weld, its reliability is likewise guaranteed. In short, in all cases in which considerable loads must be carried through the attachment, and particularly in heavier-gage stampings, projection welding is definitely recommended over spot.

There is, however, one shortcoming of the projection weld, particularly in wheel construction. Generally speaking, it is desirable to perform wheel operations in an axial direction rather than the radial, due to the elimination of indexing on the one hand or expensive contracting dies on the other. Projection welding fits these requirements satisfactorily, as usually the question of structural deformation arises only when radial operations are employed. On the other hand, however, there enters an over-all power consideration. If two plates are to be welded with a series of projections, obviously the entire welding must be performed at the same time. If the push-up or the collapsing of the projections is different for every projection, either one or both plates must distort correspondingly. This distortion is to be avoided; not only is the structure thereby affected by differential cooling strains, but it tends to overload neighboring projections, even to the point of causing initial rupture. Granting, therefore, that all projections must be welded simultaneously, it is readily seen that the maximum transformer capacity which it is feasible to obtain can readily define limits in which projection welding can be employed. As a matter of fact, the hub shell represents a fairly limiting condition in this respect.

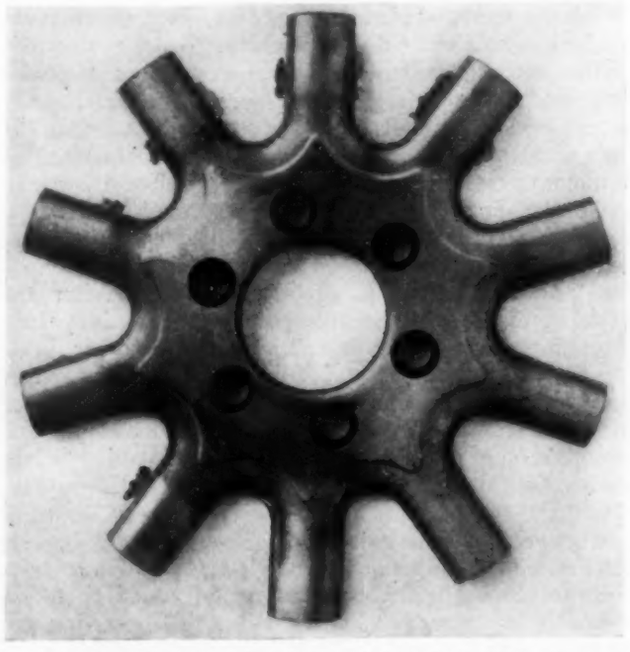
Spot welding is subjected to no such restrictions. Here it is merely a matter of time necessary to perform any given number of spot welds. For this reason, the spot weld is many times employed over the projection weld. To offset the possible unreliability of the spot weld a greater number may be employed, thereby gaining the necessary factor of safety.

Summarizing the flash and butt weld along with the projection and spot weld, there are certain definite characteristics common to all and of noteworthy consequence. In the first place, all welds are microstructurally forgings. The function of the current is merely to heat the material preparatory to the mechanical action of forging. Consequently in these forms of welds the physical properties of the material in the weld resembles that of the forging, even though probably in a more brittle state due to the repeated quenching action imposed by the surrounding material. Notwithstanding, this forging characteristic is highly desirable over the casting characteristic which usually attends in the common forms of arc welding now about to be described. In this direction, it should be borne in mind that the ductility of the forging weld can be greatly affected by the combination of the imposed conditions of voltage, amperage, pressure and time. In the case of the projection weld, the height and shape of the projection is also an influential factor. In the case of the flash weld, the amount of material and therefore the follow-up travel is likewise an important factor.

## Arc Welding

In practically all production operations where arc welding is employed, it is usually in the form of mechanical or automatic arc welding. The main differentiation between this and manual welding lies in the feeding of the electrode with respect to the work. The manual operation of the arc-weld is governed by the judgment of the operator, while in automatic welding the length of arc is controlled usually by voltage. In this manner a more uniform length of arc can be obtained than in manual welding, and accordingly a more reliable and consistent weld results. Again, the travel of the work and therefore the linear travel of the weld is mechanically regulated so that again variations which would otherwise result from the human equation are absent.

There are two major types of automatic arc welding. The carbon arc employs a carbon electrode. Here the work edges are melted under the intense heat of the carbon arc and are caused to fuse or weld together. Note that no added deposition of material is made. The advantages claimed for this kind of welding lie in the elimination of the cost of welding wire as is required in the metallic arc weld. The disadvantage lies in the inability of making a large number of welds without attention to the machine. The carbons are used in the form of rods which require frequent replacement as against the coil of wire which will last for a considerable time.



**The two half stampings of the Budd artillery steel wheel as flash welded, prior to flash removal**

The metallic weld, as already indicated, employs a welding wire fed from a coil. In this case the welding wire is the electrode and deposits in a molten state upon the equally hot working edges. In this manner a bond is made between the two edges and the welding wire. As the wire burns off, new wire is continually being brought into the zone of the arc by the automatic feeding mechanism, holding arc length constant.

The fundamental difference between arc welding and the flash and butt welding or projection and spot welding lies in the microstructure of the weld. As is seen, the arc weld is merely a melting and fusing operation with a cast structure naturally resulting. Accordingly, care should be exercised in the employment of this weld, particularly in wheels. Unless due consideration is given to the welding operation, a brittle weld might easily result which would be particularly undesirable in the wheel structure. Usually most members and the attachments of the wheel are subjected to high degrees of impact and fatigue. A weld to withstand this type of loading should possess a fair degree of ductility. Consequently if the flash weld or arc weld is to be employed special attention should be given to this consideration.

As against this shortcoming the arc weld may be successfully employed by virtue of its configuration in many cases. In short, it is inherently a continuous weld, and for this reason a much greater weld (in circumferential length) usually obtains, than that which would otherwise be employed in the form of say, a projection weld. Again, by the very virtue of its continuity a more uniform distribution of stress throughout the attachment is realized as compared to the localized attachments coupled with the projection weld.

Again, in most all cases in which the arc weld is employed in the automobile wheel, it is not required to carry the entire load, and as a matter of fact in most cases only a small part thereof. Accordingly, wheels incorporating this type of welding have proven very successful providing proper attention is given to the welding operation.

Although this form of welding is relatively slow as compared to projection or flash welding there are manufacturing advantages which justify its employment. In the first place the equipment cost is low and highly flexible. Usually crude fixtures can be used in place of very expensive dies which would otherwise be required for projection and particularly for flash welding. Again, although the speed is low, one man may operate two or three welders, so that the man-time is not necessarily excessive. Although more machines are required, the unit price per machine is sufficiently low to justify this type of welding in certain places.

Completed Budd artillery stainless steel wheel

With these reasons it has been found that automatic arc welding can be most advantageously employed in welding the disk to the rim on the Budd truck wheels. As far as the writer knows, the Budd wheel marked the entrance of this kind of welding in this wheel location and continues to be individual in this respect. It should be noted that the weld in this case is particularly suited, as in the first place the direct loading between disk and rim is taken through a tight fit which exists between both members. Again, by the continuity effect of the weld a closed-in, or virtually integral, structure between disk and rim is accomplished, with the complete removal of possible squeaking. In addition, by virtue of this solid tie-in the disk can more effectively assist the rim, and conversely the rim the disk. As for the economy of the operation, it has been found that on the larger sizes welding of this nature is cheaper than riveting. It should be borne in mind that a natural advantage inherent to welding presents itself in saving of disk material. The riveted wheel requires a considerably wider disk flange than does the welded one, and this difference in stock has great effect in the economies produced by welding.

The older form of welding the wire wheel hub shell was also that of arc welding. However, subsequent redesign of the shell, permitting of projection welding, caused arc welding to be dropped. It should be noticed that here also when arc welding was employed, very little loading was carried directly through the weld as both the pressed fit and the wire spokes assumed the major share of the attached loads. Although no trouble was experienced with this weld under this type of load, considerable trouble has been experienced with the arc weld in other forms of wire wheel hub shells. In these cases usually a greater load was imposed upon the weld in the nature of either a high thrust load or torque (shear) load.

## Welding Selection

It has been the aim of this article, first to emphasize the possibilities of the employment of welding in automobile wheels in the light of progress which has been made in all forms of welding. It has also been the purpose to cover briefly the salient features of the various forms of welding and in this way to indicate the proper selection of welding essential for the given wheel attachment under consideration. By bearing in mind and becoming more acquainted with the possible advantages of various forms of welding, the design of wheel structures may be so modified as to employ that form of welding which is advantageous. The best example of this is evidenced in the redesign of the Budd wire wheel hub shell to permit of projection welding. It should also be borne in mind that that weld which is best in one locality is not necessarily the one which is best suited to another. The cross-section of the welding which is employed in the Budd wheels will evidence this point, as it has been shown that all forms of welding are being actively employed in one location or another in the three major types of wheels, namely, wire, disk and artillery steel.

# Ideas from PRACTICAL MEN

## Temperature Control of Quenching Baths

WARREN F. MANTHEI

It has been the general practice to temper most grades of steel in oil rather than in water, the process, however, having certain objectional features because of fire hazard, expense, and the great difficulty of cleaning such steel afterwards if it is to be plated or painted. Many manufacturers are now cadmium plating or chromium plating hardened steel parts. It was discovered that in the hardening of steel, which was to be used for farm implements and many other purposes, the tempering could be done just as well in water as in oil, providing the water was heated and maintained at exactly the proper temperature, this being usually 160 deg. F. A typical installation of this kind in a plant of a large manufacturer of farm implements is described as follows:

A bath is of the open type about 3 ft. high, 3 ft. wide, and 6 ft. long. It is filled with water to about 3 in. from the top, an overflow pipe carrying off the excess.

A thermostatic regulator with a temperature range from 50 deg. to 250 deg. F. is used to control the flow of steam and cold water into the bath. The steam line is brought into the bath to the bottom, the steam flowing into the water direct through a perforated pipe. The water supply line is secured along the top of the bath, the cold water entering the bath through a similar perforated pipe at the surface of the bath.

The operation is as follows: The operator opens the steam and water supply valves and turns on the thermostatic regulator. The steam enters through the perforated pipe in the bottom of the bath and heats the water to the temperature desired, say 160 deg. When this point has been reached the regulator shuts off the steam supply and maintains this temperature within two or three degrees. When the hot metal is placed in the bath the temperature of the water is raised, the regulator then opens the cold water valve, allowing the cold water to enter the bath at the surface and cool off the quench water.

The steam and water supply valves operating from a thermostatic regulator keep the temperature of the quench water at the point set, irrespective of any condition imposed, whether the bath is being used or not. It is always ready for use and requires no attention.

In those cases where oil, or salts having low melting temperatures are used in quenching cutting tools or other steel parts, automatic temperature control will add greatly to the uniformity of the temper by keeping the quench bath at the correct temperature.

In summing up the advantages of temperature control for quench baths we find:

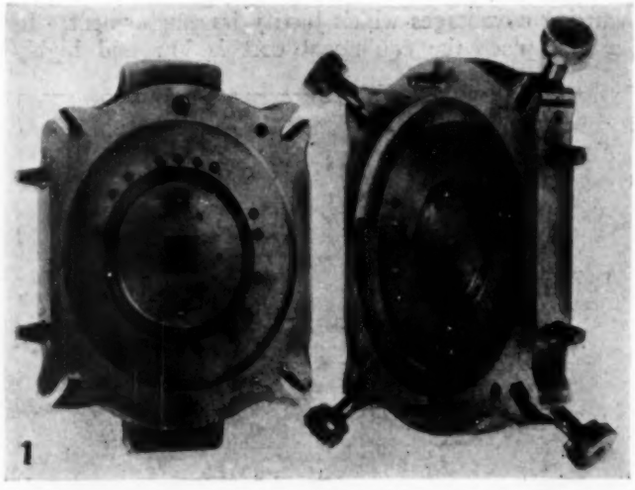
1. A better tempered product;
2. A saving of the operator's time in adjusting the temperature of the baths;
3. A substantial saving of fuel, whether steam or gas, by preventing overheating;
4. The elimination of fire risk, expense, and difficulty in cleaning where water properly controlled may be substituted for oil.

EDITOR'S NOTE: *Heated water will undoubtedly have quenching characteristics more nearly like oil than cold water. However, the difference in specific heat still remains. What do other readers think about getting identical results with oil and hot water?*

## Jigs of Aluminum Alloy

H. S. GRAY
*W. & L. E. Gurley*

The modern, strong aluminum-alloys are playing an important part in practically all types of machines today, but they have not yet been used extensively for jigs and fixtures. We have a quantity of jigs and fixtures made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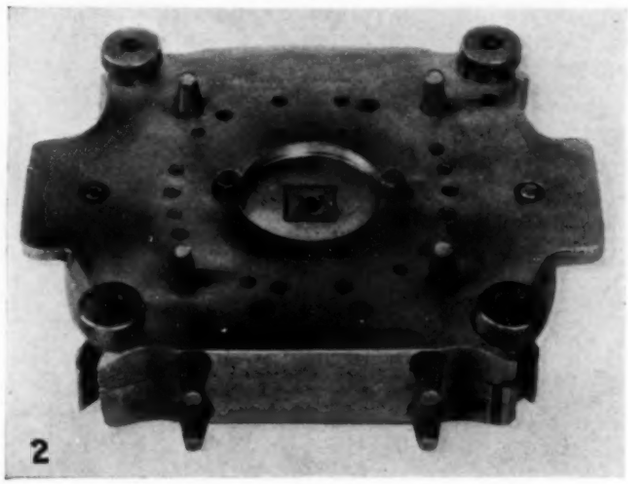
from this alloy. They have been giving excellent service for the past ten years without showing any warping or deterioration. The most important advantage in the use of the light-weight alloys is the great saving in weight. A light-weight jig is desirable because it is important that it be easily and accurately located under the drills to prevent them from breaking, especially when drilling small holes. A jig of light construction can be located

with a minimum of effort and fatigue on the part of the operator, thereby increasing his efficiency.

Another great advantage in the use of aluminum alloy is the saving in time in making the jig. This alloy machines easier and quicker than does cast iron, which is ordinarily used for such work. Also, there are fewer blow holes and less sand in the casting, and the scale does not have such a dulling effect on the tools. The jig, shown open in Fig. 1 and closed in Fig. 2, is used for drilling the top plates of transits. It has been in use for about seven years and has proved so satisfactory that five more have been made for other sizes and styles of plates.

The usual practice is followed in the construction of the jig. All holes are bushed with hardened bushings, and steel feet are provided for it to stand upon. It has a total of 41 holes, ranging from No. 16 to No. 50, drill size. The top half or cover is removable from the base and is located by means of two dowel pins in the base.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The four clamping bolts are hinged at their lower ends, and a half turn of the nuts permits the bolts to swing clear of the cover, which can then be removed from the base for inserting the work. After the work has been placed in the jig, the cover is clamped in place. Two clamping screws are then screwed down against the work, preventing it from moving while it is being drilled. The holes for these clamping screws are tapped directly in the aluminum and still show very little signs of wear.

Twenty holes are drilled from the top of the jig. It is then turned over and after drilling nineteen holes from the bottom it is turned on edge and the remaining two holes are drilled. It is then returned to its original position, the cover is unclamped and the work is removed. The jig weighs 12 lb., whereas a jig of cast iron would weigh 30 lb. The cost per lb. of aluminum alloy is considerably higher than that of cast iron, but the discrepancy is offset by the difference in weight and the saving of time in machining. The greatest gain, however, is obtained from the increase in efficiency on the part of the operator because of easier handling.

## Pipe Bends by Cutting and Welding
### *Discussion*

WALTER R. PARKINSON
*Wood Fibre, B. C., Canada*

In an article under the title given above (*AM*—Vol. 75, page 181), Henry C. Francis describes a method of making pipe bends from sheet metal. I would suggest that such bends in piping of any description, unless for a temporary job, are decidedly unsuitable. For instance, in the double bend *C* there are six cuttings and six weldings, and I am assuming that steam at high velocity and high pressure has to impinge on these six sharp angles, thereby reducing both velocity and pressure before doing any useful work.

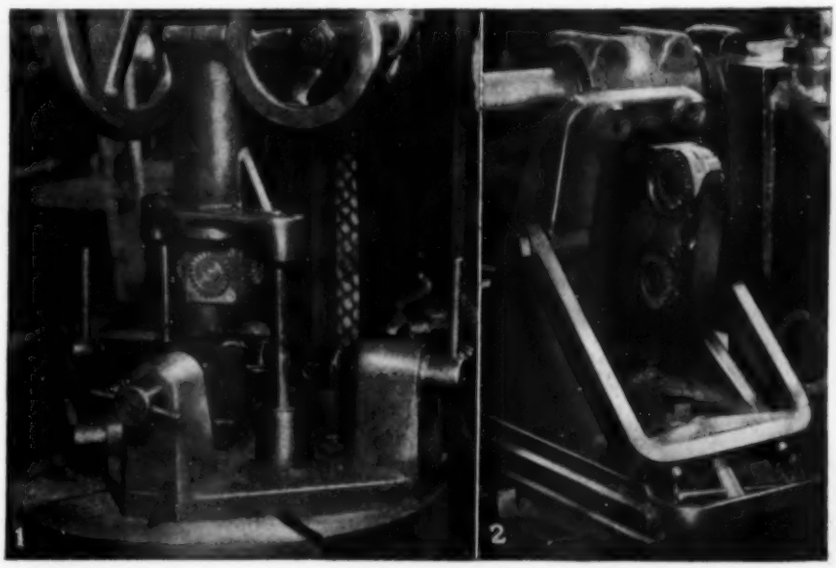
Then again, with all due respect to the welders, there are six opportunities for leaking steam, whereas in nicely bent pipes the steam, or liquid, flows around at a minimum of friction and with practically the full strength of the pipe. Besides, properly bent pipe makes a much better looking job. Occasionally, I imagine that some of our designers are quite obsessed by the cut and weld process to the exclusion of better, and in the long run, cheaper methods.

## Milling Heads for Internal Work

HENRY C. FRANCIS

The two special milling fixtures shown aid greatly in securing commercial duplication of parts and decreased the costs. It would, in fact, have been difficult to machine these parts in any other way, except perhaps with a shaper, and this would have meant a holding fixture at least as expensive as the one shown. The shaper tool would, of course, cost less than the milling head but would not be as satisfactory or as rapid.

The case to be milled in Fig. 1 is shown held in place at four points, the inner ends of these bearings being faced simultaneously by the cutter head that is clamped to the sleeve of the drilling machine and driven from the spindle. The four cutters are driven by a sort of differential gear arrangement inside the head, each cutter having its own driving gear on the inside of the case. The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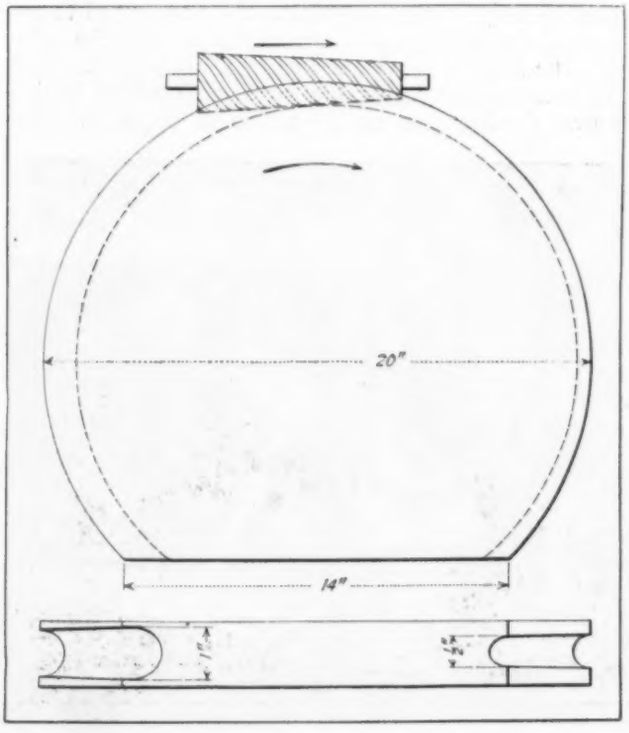
milling head is positioned by the two guide posts in the work holding fixture. Another milling head, also with four cutters, but so arranged as to be driven by spur instead of bevel gears is seen in Fig. 2. This milling head is clamped to the overarm and the column of a hand miller, the cutters being driven by a gear train from the milling machine spindle.

With the table moved to the right, the case is located on the pads shown on the work holding fixture and positioned by dowels. It is held against the pads by a screw clamp in the yoke that is swung down to receive the work. The work is then fed by hand to the proper depth, determined by a fixed stop. Both of these milling heads can be adapted to suit a variety of conditions.

## A Puzzling Taper Groove

One of our readers has a problem. He has a disk 20 in. in diameter by 1½ in. thick. One edge is slabbed off so that there is a flat of about 14 in. like an interrupted roll that is used to form shotgun barrels. The problem is to cut an accurate taper groove, beginning at one end of the flat place and ending at the other, along the periphery of the disk. The cross-section of the impression is to be a half circle ½ in. diameter at one end and 1 in. diameter at the other, with a constantly increasing taper. It was suggested that a good toolmaker could rough it out on a lathe and then finish it with flexible files or a grinder. This solution was not satisfactory and another solution was offered: Make a spiral, taper milling cutter ½ in. in diameter at one end and 1 in. at the other. Make the length of this cutter some ratio to the length of the groove it is to cut—this ratio to be one that can be accommodated by the feeds of the machine. The length of the spiral cutter will, of course, be limited by the question of rigidity, but we will assume a ratio of 5:1, which will make the cutter between 8 and 9 in. long. In cutting, the small end of the cutter would be placed at one end of the flat and both disk and cutter fed in the same direction at feed ratios of 5:1. The only trouble with this solution is that it does not cut a true half circle because the larger end of the cutter will touch the groove before it reaches the center line. True, the interference is slight, but still it is there. The first problem is to determine the amount of this interference. If it is too great, the second problem is to devise a more practical method of machining the groove.




## An Inverted Punch and Die—*Discussion*

H. ROSE
*London, England*

The piercing tools described by Charles H. Willey in an article under the title given above (*AM*—Vol. 74, page 914) is open to some friendly criticism. In the first place, little or no advantage is gained by inverting the tools. In the second place, the overhang necessary in tools of this design robs them to a large extent of the rigidity that is essential in piercing stock of the nature

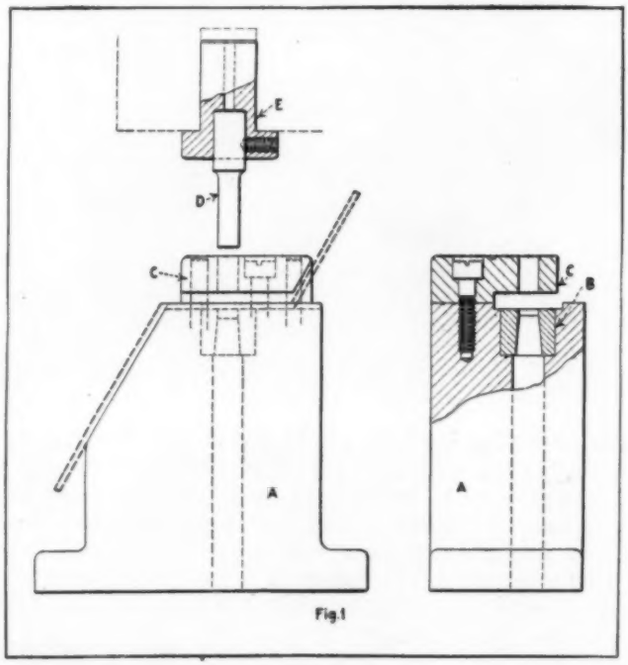


Fig. 1

described. As alternatives, I would put forward the designs shown herewith. Since the tools described by Mr. Willey are apparently temporary ones, being designed with the object of converting existing stock, initial cost being an important consideration, the tools shown in Fig. 1 will be found quite satisfactory in use.

The bolster *A* is of mild steel, not necessarily hardened, and is fitted with the hardened die-bushing *B*, which is pressed in position. The stripper *C* is securely screwed and doweled to the upper face of the bolster and is bored for a good sliding fit for the punch *D*, which is held in the adapter *E* by a setscrew. The work is located in a slot in the upper face of the bolster, as shown in the part sectioned in the view at the right, endwise location being taken care of by the angular face of the bolster, on which the work is shown in heavy dotted lines in the view at the left. To keep the punch as short as is possible, the work is located with its short leg projecting upward, and as this leg is at an angle suffi-

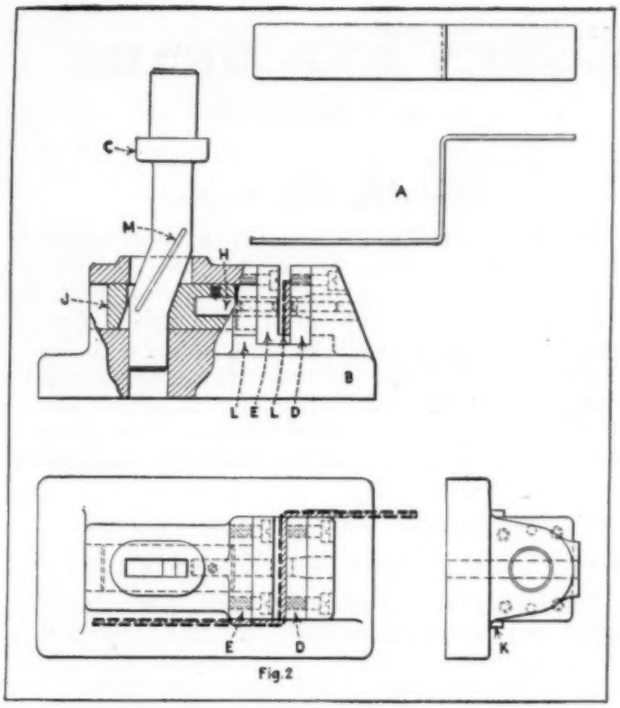


Fig. 2

cient room is left for the ram to approach reasonably close to the work.

When work similar to the example given by Mr. Willey, but having right-angle bends, as at *A* in Fig. 2, has to be pierced, the tools previously described would probably be unsuitable, owing to the excessive length of the punch required to reach down into the work. In such cases, leg piercing-tools of the design shown in Fig. 2 would give satisfactory results. These tools are built on the heavy cast-iron bolster *B*, which is clamped to the press bed, the leg punch *C* being held in the ram. The work, shown in heavy dotted lines, is located across the face of the die-plate *D*, which is secured to a vertical face of the casting by screws and dowels.

The punch guide-plate *E* is similarly secured to the opposite face and is bored for a sliding fit for the punch *H*. This punch is carried in the hardened plunger *J*, which slides in a hole in the casting *B*, and is slotted to receive the leg punch *C*, as shown in the elevation. In operation, as the leg punch descends, the plunger and its punch are forced toward the die through the angular faces on the leg punch and the plunger, the work located on the die-face thus being pierced. Stripping is effected on the return stroke as the work contacts with the guide plate. Additional support is provided for the legs of the work by the lugs *K*, the faces of which are machined to the same level as that of the face *L* on the punch-plate which locates the work at the correct height.

In assembling the tools, the punch-plate is placed in the bolster with its screws in position, the screws being reached for tightening through corresponding holes in the die side of the casting. Oil grooves should be machined in both sides of the leg punch at *M*.

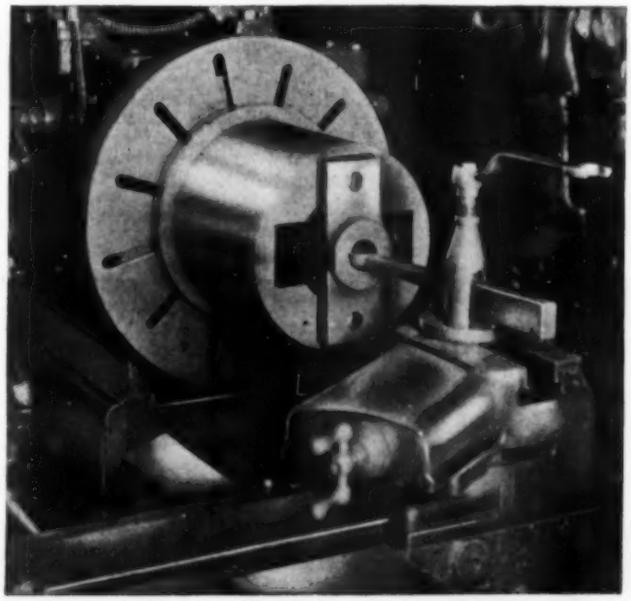
## Boring and Locating Valve Rod Crosshead

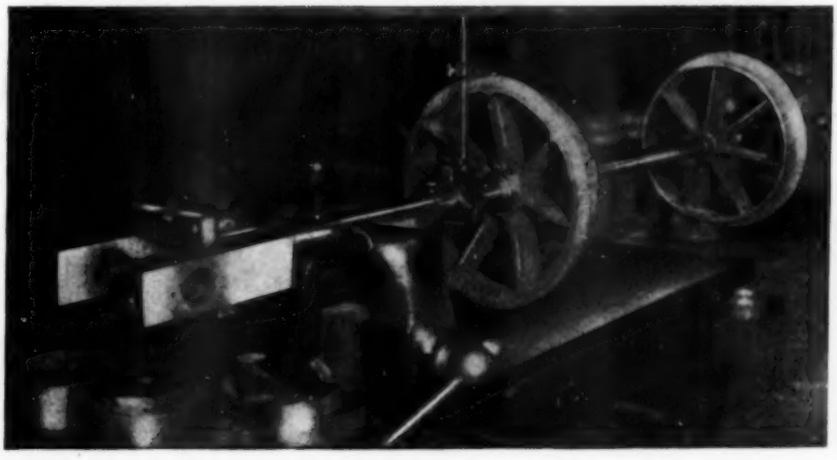
FRANK C. HUDSON

Valve-rod crossheads are made in two sizes on the Norfolk & Western but both can be centered and bored in the chuck shown in Fig. 1. The use of the chuck requires no explanation except perhaps to call attention to the hollow-headed screws used for clamping the work.

In fitting the crossheads to the valve rods in the Roanoke shops, it is desired to have the dowel pin in the valve spider come at the bottom, or 90 deg. from the crosshead. This is to bring the dowel pin directly over the lower longitudinal bridge in the valve chamber to prevent the pin from dropping or springing out into the ports and causing damage. A plumb bob was formerly used to locate this dowel-pin hole but this gave way about five years ago to the method shown in Fig. 2, which is not only more accurate but much faster and better in every way.

The valve rod is first clamped in the vise, using false copper jaws or covers to prevent marring the rod. The false cover is in one piece, the curve between the jaws making it easier to handle and preventing the cover from falling out when putting the rod in place. The crosshead is keyed on the rod and leveled as shown. The follower or spider head is put on and keyed in position. Then the centering gage is placed around the rod near





the spider, leveled by means of its own small level, and clamped in position. The upright is so located that one side of the arm is at the center line of the rod, this making it easy to scribe the center line for the dowel pin. The clamp for the upright is easily handled so that it can be easily put on and clamped in place quickly.

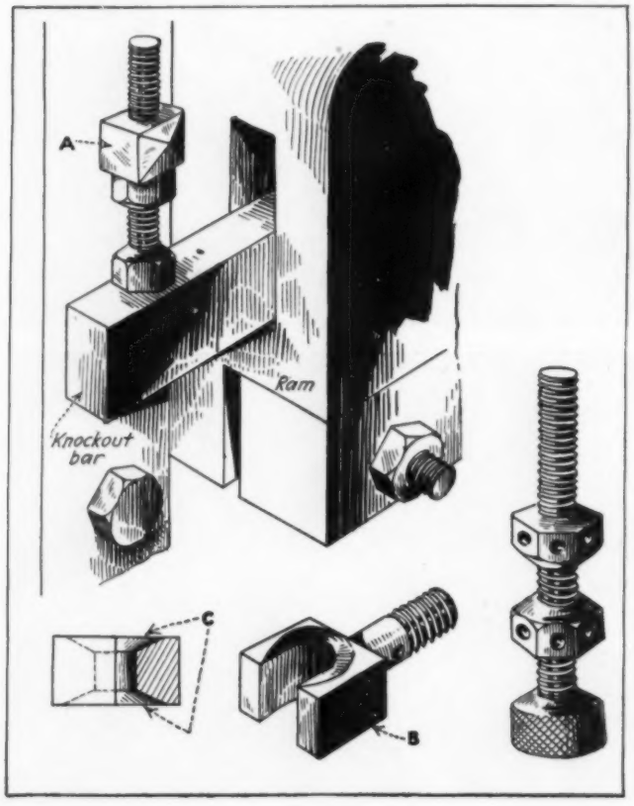
## Quickly-Adjustable Screws for Knockout Bars

CHARLES H. WILLEY
*Superintendent of Manufacturing, Hoyt Electrical Instrument Works*

Almost all of the conventional types of power presses have knockout bars in the rams for stripping the work from the punches. The adjusting screws for the knockout bars are generally threaded through post nuts held in one of the gibs of the rams, as indicated at *A*. It is a time-consuming task to turn the long screw up or down very far in the stationary nut, especially if the threads have become battered or injured in any way.

We have changed the method of holding these adjusting screws in all of our presses. The stationary nuts have been replaced by holders having plain holes slotted so as to be open at front, as at *B*. The top and bottom surfaces are countersunk, as at *C*, for the reception of the conical faces of the locknuts. Thus, when the locknuts are tightly in place, the screws are confined in the holders, but when the nuts are loosened, the screws can be removed through the slotted openings.

It will readily be seen that this arrangement makes the task of the die setter shorter and more agreeable, for he can remove the screw and adjust the nuts approximately. The screw can then be put back in place and the adjustment can be quickly completed.




# SEEN AND HEARD

JOHN R. GODFREY

### Chuck the Tack Hammer

Air travel is developing faster than many of us realize, even though we are not building as many planes as we might wish. But when I go through a plant where the wing ribs are being built up of small pieces of wood, glued and tacked together on the order of cigar boxes, I get the feeling that the real commercial plane must throw this sort of work into the discard. Metal ribs are in use in some planes and the fuselage is now metal in most planes. It seems time to abandon the tack hammer and the glue pot.

### High Speed Forty Years Ago

Predictions of 100-mi. road speeds for automobiles must not be taken too seriously, at least as long as drivers' licenses are issued to almost anyone who applies. The faster we go the quicker must emergencies be met, and the average driver is none too quick at present. Then, too, it is well to remember the experience of the railways. There are cases where the running time is slower than it was forty years ago. Trains were run between New York and Philadelphia in 90 min. or less away back in the '80's, but the present schedule is not at this speed. The tear-drop car seems to offer a solution. It would give us 50 to 60 m.p.h. with less power.

### Insist on Quality

Cracking and scoring in the steel molds used for die casting, especially for metals poured at high temperatures, such as aluminum and brass, have long been bugaboos. A long series of investigations made in Germany with characteristic German patience has shown that where these "checks" occur are to be found streaks of manganese sulphide in the original steel. The tests were with chromium steels, vanadium steels, and tungsten steels, the types most used for hot dies. Manganese and sulphur in minute quantities are to be found in all steels. Apparently there is nothing the production man responsible for the molds can do about it except to insist on the purchase of steels from producers who have reputations for skill in manufacturing and uniformity of product.

### Cast Iron Systems for Shops

Premium systems, bonus plans and other wage incentives all have their place but are all too frequently misapplied. And after you establish any kind of a payment plan it is difficult to monkey with it without causing suspicion among the workers. Some industrial engineers have a pet plan that they try to put in all shops and it usually isn't the right plan for that shop. In many cases conveyor systems time the output so that day wages are just as satisfactory as any other plan. And in many other cases the extra fast man only piles up parts that are of no use so far as a completed product goes. Systems should be fitted to the plant.

# SHOP EQUIPMENT NEWS

## Gould & Eberhardt Nos. 12-H and 12-H Heavy Universal Gear Hobbing Machines

For accurate production of single helical and built-up herringbone gears, such as used in silent and synchro-mesh transmissions, Gould & Eberhardt, Newark (Irvington), N. J., have added two universal, manufacturing-type gear hobbers to their line. These machines are known as the 12-H and 12-H heavy. The 12-H has capacity to cut gears up to 12 in. in diameter with the support in place and 18 in. with the support removed, and is rated for 5 D.P. in steel. The weight is 4,600 lb. The 12-H heavy hobber has capacity to cut gears up to 12 in. with the support and 18 in. without the support, and is rated for 4 D.P. in steel. The weight is 6,600 lb.

These universal type machines employ the vertical cutting principle with the cutter slide mounted on an adjustable stanchion and the work spindle fixed in the base of the machine. The hob slide travels on double rectangular guides, provided with independent adjustments. The swivel cutter head has an angular adjustment of 180 deg. to permit cutting both right- and left-hand helical gears of any angle. To utilize the full length of the hob, a positioning device is provided to shift hobs axially to additional cutting positions without removing the hob.

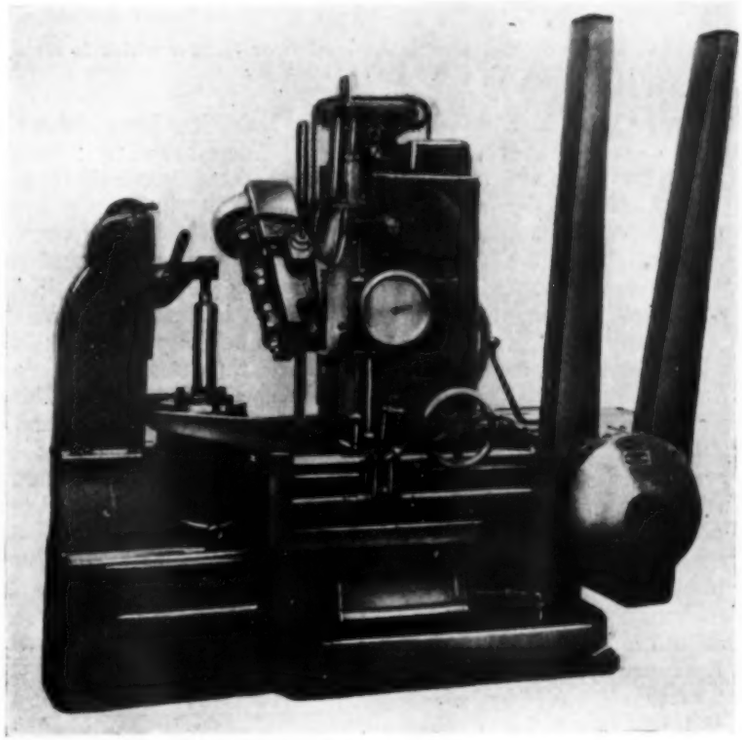
Power rapid traverse moves the cutter rapidly in either direction, and may be operated when the work and cutter spindles are idle or rotating. Traverse and feed controls are interlocked. An adjustable cam is provided to stop the rapid approach, and a safety pin prevents accidental downward operation of the power traverse.

The cycle of cutter movement comprises three phases — rapid approach, feed and rapid reverse, each automatically arrested at a predetermined point. Feeding motion is automatically disengaged by the main clutch, but leaves the power traverse available. Adjustable stops govern the movement of the feed and traverse, and fixed safety stops control the extreme limits of motion.

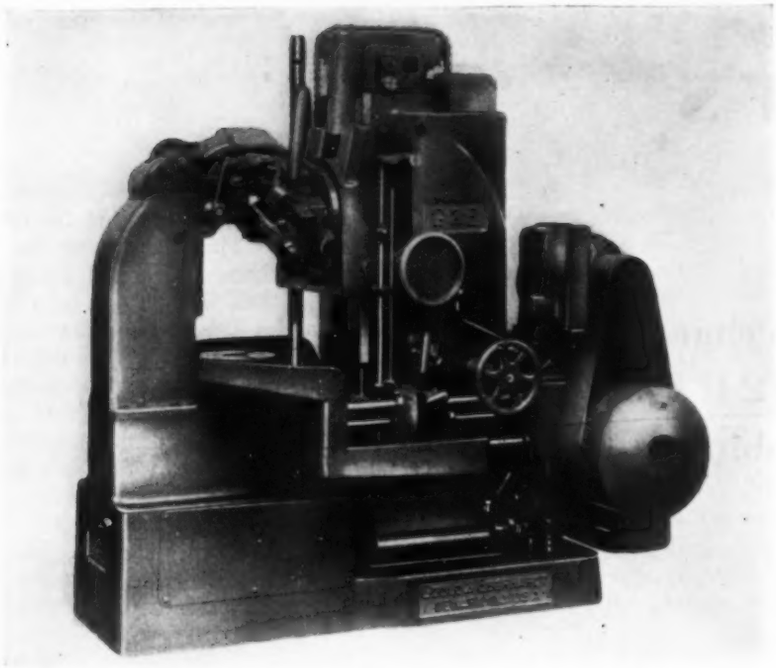
The work table on the 12-H heavy machine is located in a large tapered bearing, directly within the base casting, and is arranged with independent means for adjustment for maintaining the diameter and end fits of the spindles. The work table on the 12-H machine is likewise located in the base, but is mounted on Timken bearings. The work arbor support is of a box type with an adjustable arm that can be locked in any position. A single lever adjusts, locks and swivels the arm. The entire work arbor support unit can be removed when cutting large gears.

The cutter spindles on both machines are arranged with adjustment features. The diameter and end fits of the spindle are adjusted independently and maintained without disturbing the setting of any other fit, or without dismantling or refitting the machine.

Pressure lubrication supplies oil to the main mechanism in the gear case and to the work spindle, and includes cascade oiling to the change gears inclosed in an oil-tight compartment. The worm and worm-wheel drives to



**Gould & Eberhardt 12-H Universal Gear Hobber which has capacity up to 12 in. with the support in place and 18 in. with the support removed, and is rated at 5 D.P. in steel**



Gould & Eberhardt 12-H Heavy Universal Gear Hobber which is rated at 4 D.P. in steel

the cutter and work spindles are immersed in oil. The cutter slide guide ways, stanchion and immediate parts are lubricated by a gravity system. A separate pump and reservoir supply coolant to the hob.

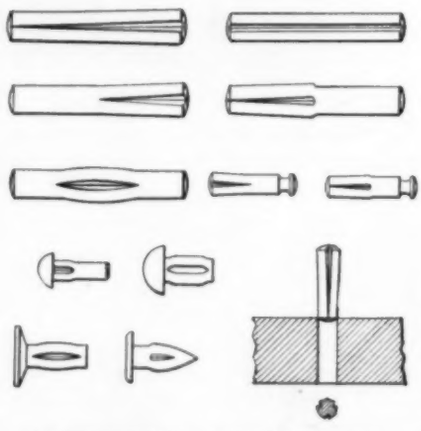
A single constant-speed driving pulley, mounted on anti-friction bearings, is used on these machines. Power is transmitted through a plate-type clutch arranged with a single convenient adjustment. A safety frictional slip gear is interposed in the power traverse drive.

When motor drive is required, a direct-connected drive can be made with either belt or silent chain. A constant-speed motor of 5 hp., 1,200 r.p.m. is recommended for the 12-H machine and a 7½-hp. motor for the 12-H heavy machine.

The machines may be supplied with full equipment for cutting a diversified range of spur and helical gears, or with limited equipment for cutting one specific gear only. An automatic infeed mechanism for hobbing wormwheels with the infeed method is available.

## Groov-Pins and Drive-Studs

Fastenings on a wide variety of parts can be made with Groov-Pins and Drive-Studs which have been developed by the Groov-Pin Corp., 47-18 37th St., Long Island City, N. Y. The Groov-Pin is formed by pressing three longitudinal grooves into a straight pin, thereby upsetting the stock at its circumference. As shown at the lower right of the accompanying illustration, driving a Groov-Pin into a drilled hole forces the upset bulges partly back into the grooves, thus assuring a force-fit within the drilled hole. This type of pin may be used more than once, because the resilient bulges spring back into their original position after knocking out. While tapered grooves are mainly used for Groov-Pins and studs, other forms have also been evolved.



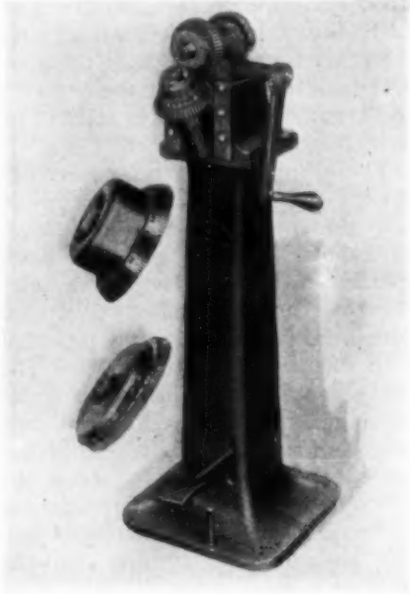
Representative Groov-Pins and Drive-Studs and section of the pin with three upset bulges

Special types or grooved parts can be made to order in triangular, hexagon and square grooved bars. Groov-Bolts are also manufactured. These grooves prevent rotating of the bolt, no wrench being required to hold it when tightening the locknut.

The Groov-Pins are available in sizes from $\frac{1}{16}$ to $\frac{1}{2}$ in. in galvanized steel and other metals and alloys.

## Noble & Westbrook No. 48 Graduating Machine

For graduating beveled micrometer collars in an economical manner, the Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn., has developed the No. 48 graduating machine. This development is a heavier model than those previously built by the company and has several improved features. The marking die is carried on the spindle, the spindle being driven by hand power through spiral gears. The micrometer collar being marked is held on a separate spindle placed at



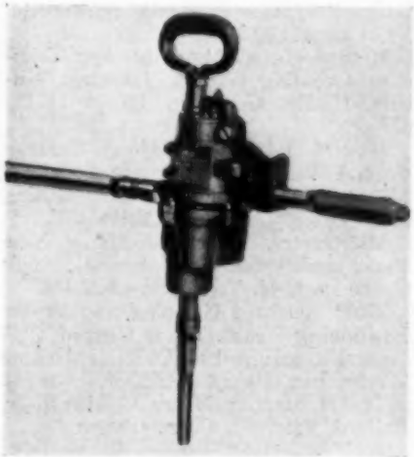
the proper angle to bring the beveled marking die and the beveled micrometer collar together. The collar is held on the arbor with a U-shaped washer, and the collar and marking die are geared together. Pressure is applied through a cam concealed in the base of the machine, this being operated by a treadle. To graduate and number a complete collar it is

necessary only for the operator to place a collar on the machine, apply the pressure, and turn the handle two or three times, depending on the depth of mark wanted.

This No. 48 machine can be arranged to mark a number of sizes of collars, providing the same degree of angle is maintained on all sizes. A separate marking die, however, is required for each size collar and also if different graduations are wanted on the same size collar. The machine weighs approximately 300 lb., and requires a floor space of 15x20 in.

## Thor No. 254R Pneumatic Tapper for Stud Holes

A rotary pneumatic drill especially adapted for tapping and re-tapping stud holes on locomotive boilers has been developed by The Independent



Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. This tool is capable of tapping new holes up to and including 1 in. and re-tapping holes up to and including 1⅛ in. It has cut the time on this sort of work to one-fifth of time formerly required by hand methods. The tool can also be used for tapping new threads in cylinder head castings on locomotives. While designed for tapping, the No. 254R can also be used for putting on and taking off nuts, capscrews and lagscrews.

Specifications are as follows: speed, 100 r.p.m.; weight, 19 lb.; length overall, 14½ in. The spindle fits W.W. sockets only, of which three are included as standard equipment.

## Hammond Automatic Composition Feeder for Polishing and Buffing Machines

For use on polishing and buffing machines of the full-automatic and semi-automatic types and for hand-polishing and buffing lathes now in service, the Hammond Machinery Builders, Inc., Kalamazoo, Mich., has developed an automatic composition feeder. This device reduces cost in both material used and time of applying composition to polishing and buffing wheels. It is operated by means of compressed air and the composition paste is delivered through a distributing nozzle directly onto the polishing or buffing wheel. The centrifugal force of the wheel carries the composition to a collector pad which is clamped on one end of the nozzle. This collector pad presses against the polishing wheel. The proper amount of composition necessary can be fed to the wheel either constantly or intermittently. If the latter is preferred, either a hand or foot control is supplied. The feeding nozzle is equipped with an adjustable discharge spout, which may be adjusted for flat, irregular or curved contours on the wheels. This nozzle is supplied in sections and can be built up to lubricate any width of wheel. A flexible hose permits a wide adjustment of contact points.

## "Tructier" Tiering Truck

A tiering truck that steers with all four wheels, drives from the rear wheels and is powered with a tractor-type gas engine capable of twenty-four hours' continuous operation is announced by the Clark Tructractor Co., Battle Creek, Mich.

The method by which all four wheels turn in response to the steering control enables the truck to get into tight places with its load and get away easily. The turning radius is 94 in. and the truck will easily negotiate the corner of two intersecting 64 in. aisles with ample clearance on each side. The hydraulic lift applies maximum power to point of service without drum or other complicated

mechanisms. Besides utilizing all the advantages of the hydraulic lift it also cushions the descending load without shock.

The "Tiertop" model is recommended for factory and warehouse use. It tiers a 3-ton load to 6 ft. in 30 sec. Heavy dies may be positioned on presses, heavy units in process may be positioned on machine tools, material for storage is quickly and compactly tiered on skid platforms.

The "Tiermor" model tiers 3 tons to 4 ft. in 18 sec. and, due to its low over-all height, is especially adapted to loading and unloading freight cars. It enters the car and takes the load to the far end, spots it where it is to ride, and comes out of the car with no jockeying. Its

"Tiermor" 3-Ton Truck for unloading freight cars

flexible mobility and the construction which permits the driver to have clear vision at all times are advantages.

## Duff-Norton Aluminum Journal Jack

To effect weight savings of approximately 40 per cent over former models, the Duff-Norton Mfg. Co., Pittsburgh, Pa., has employed aluminum extensively in its light-weight car inspector's journal jack. Two sizes of jack are available, one having a capacity of 15 tons and the other of 25 tons. Both models are equipped with a positive stop safety feature to prevent the lifting standards from becoming disengaged. The 25-ton jack weighs only 26 lb., and the smaller jack, 19 lb. This saving in weight is made possible through the use of a heat-treated, aluminum-alloy sand casting as the housing for the steel lifting mechanism. The aluminum alloy shell is highly resistant to atmospheric corrosion, particularly under conditions surrounding railroad property, and therefore the jack is practically impervious to all weather conditions.

# PATENTS

SEPTEMBER 8, 1931

**Metal-Working Machinery**

Internal Grinding Machine For Grinding Out Bores Accurately. Karl Jung, Berlin, Germany. Patent 1,822,222.

Grinding Machinery. John E. Caster, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,822,337.

Grinding Machine. Cecil W. Hopkins, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,822,348.

Welding Machine. William F. Pioch, Detroit, and Charles J. Martin, Dearborn, Mich., assigned to Ford Motor Co. Patent 1,822,371.

Continuous Rotary Machine. Adolph L. De Leeuw, Plainfield, N. J. Patent 1,822,690.

Fluid Pressure Operated Continuous Rotary Machine. Adolph L. De Leeuw, Plainfield, N. J. Patent 1,822,691.

Adjustable Drive For Spindle Feeds. Adolph L. De Leeuw, Plainfield, N. J. Patent 1,822,692.

Sheet-Metal Working Machine. Paul R. Hahnemann, Buffalo, N. Y., assigned to Niagara Machine & Tool Works. Patent 1,822,697.

Method of Finishing Heads of Set Screws and Other Articles. George A. Moore, Boston, Mass. Patent 1,822,708.

Automatic Lathe. Audoin D'Halloy, Paris, France. Patent 1,822,805.

Crank Shaft Balancing Machine. Caleb E. Summers and Thomas C. Van Degrift, Detroit, Mich., assigned to General Motors Research Corporation. Patent 1,822,860.

**Tools and Attachments**

Work Chuck. William N. Booth, Detroit, Mich., assigned to Kelsey-Hayes Wheel Corporation. Patent 1,821,926.

Device For Taking Up the Wear On Antifriction Bearings. Ludwig Holland-Letz, Crown Point, Ind. Patent 1,821,976.

Cam-Controlled Thread Gauge. James Hartness, Springfield, Vt. Patent 1,822,027.

Screw Thread Gauge and Method of Gauging. James Hartness, Springfield, Vt. Patent 1,822,028.

Method of and Apparatus For Trimming Grinding Wheels. Johannes Wilberz, Hilden, Germany. Patent 1,822,-073.

Method of Producing Metal Working Tools. William C. Sproul, Rockford, Ill., assigned to The Ingersoll Milling Machine Co. Patent 1,822,176.

Micrometer. Albert D. Mizzy, New York, and William E. Favini, South Ozone Park, N. Y. Patent 1,822,413.

Fluid Actuated Gripping and Work-Positioning Means. Oscar Onsrud, Chicago, Ill., assigned to Onsrud Machine Works, Inc. Patent 1,822,501.

Tool Clamping Means. Edward P. Bullard, Fairfield, Conn. Patent 1,822,-514.

Testing Gauge. John L. Monk, Oakland, Calif. Patent 1,822,599.

Precision Measuring Instrument. Eugene Letsch, Lynbrook, N. Y., assigned to Precision Scientific Co. Patent 1,822,662.

Chuck. Frank C. Wilson, Arcade, N. Y. Patent 1,822,685.

Measuring Instrument. Edward Oscar Loeser and George B. Gallasch, Rochester, N. Y., assigned to Bausch & Lomb Optical Co. Patent 1,822,740.

Hindley Worm Gear. Samuel I. Cone, Portsmouth, Va., assigned to Cone Gearing Corporation. Patent 1,822,800.

**Processes**

Method of Making Lock Washers. Carl G. Olson, Chicago, Ill., assigned to Shakeproof Lock Washer Co. Patent 1,822,600.

Method of and Device For Improving Gears. Ernest Wildhaber, Brooklyn, N. Y., assigned to Gleason Works. Patent 1,822,846.

# COLD-TREATMENT OF ALLOY STEELS

**Brinell Hardness After Liquid Air Treatments on Chrome Nickel Alloys**

| Alloy No. | 5 | 6 | 2 | 14 | 15 | 3 | 4 | 17 |
|---|---|---|---|---|---|---|---|---|
| Nickel | 4.03 | 5.06 | 5.23 | 5.36 | 5.54 | 5.99 | 7.04 | 9.20 |
| Chromium | 17.62 | 17.15 | 17.24 | 17.60 | 17.27 | 17.66 | 17.62 | 18.27 |
| Brine-quenched at 1090° C. | 418 | 286 | 286 | 171 | 185 | 255 | 241 | 116 |
| Cold-treated at —180° C. | 430 | 430 | 321 | 269 | 255 | 286 | 269 | 116 |
| Cold-treated and drawn at 100° C. | 430 | 430 | 321 | 269 | 255 | 286 | 269 | 116 |
| Cold-treated and drawn at 200° C. | 418 | 418 | 321 | 269 | 255 | 293 | 269 | 121 |
| Cold-treated and drawn at 300° C. | 418 | 418 | 302 | 269 | 241 | 277 | 269 | 121 |
| Cold-treated and drawn at 400° C. | 418 | 418 | 302 | 269 | 241 | 277 | 269 | 121 |
| Cold-treated and drawn at 500° C. | 387 | 388 | 302 | 248 | 235 | 269 | 269 | 121 |
| Cold-treated and drawn at 600° C. | 286 | 286 | 302 | 241 | 223 | 269 | 255 | 121 |
| Cold-treated and drawn at 700° C. | 311 | 321 | 302 | 269 | 248 | 269 | 255 | 121 |
| Cold-treated and drawn at 800° C. | 302 | 321 | 286 | 293 | 285 | 277 | 266 | 121 |

**Physical Properties of Steel No. 6, Containing 17.15% Cr and 5.06% Ni After Treatments Shown**

Quenched from 1090° C. (1995° F.) and cold-treated at —80° C. (—112° F.), and drawn

| Treatment | Elastic Limit Zero P. L. Lbs. Per Sq. In. | Elastic Limit .0002" Off Lbs. Per Sq. In. | Ultimate Tensile Lbs. Per Sq. In. | Elong. in 2" % | Red. of Area % | Izod Values Ft. Lbs. | Machinability R.P.M. | Brinell No. | $B_{max}$ H-300 | Specific Volume |
|---|---|---|---|---|---|---|---|---|---|---|
| As quenched | 20,000 | 22,500 | 194,500 | 17.0 | 22.6 | 91-93 | 120 | 277 | 3540 | .127700 |
| C. T. —80° C. | 35,000 | 72,500 | 231,200 | 8.4 | 9.6 | 32-32 | 88 | 444 | 9240 | .129171 |
| Draw 400° C. | 50,000 | 100,000 | 208,000 | 19.8 | 64.3 | 81-77 | 160 | 444 | 9970 | .129040 |
| Draw 500° C. | 47,500 | 82,500 | 187,200 | 20.6 | 65.8 | 78-75 | 221 | 387 | 10940 | .128709 |
| Draw 600° C. | 47,500 | 65,000 | 153,600 | 19.4 | 55.9 | 62-56 | 221 | 321 | 8270 | .128805 |
| Quenched from 1090° C. and Drawn, without Cold Treatment. | | | | | | | | | | |
| Draw 400° C. | 20,000 | 22,500 | 173,500 | 17.5 | 21.3 | 104-111 | 160 | 262 | 3370 | .127563 |
| Draw 500° C. | 20,000 | 25,000 | 171,500 | 23.6 | 37.2 | 112-116 | 160 | 269 | 4040 | .127893 |
| Draw 600° C. | 15,000 | 22,500 | 160,900 | 19.0 | 34.1 | 66-62 | 160 | 311 | 7240 | .128437 |
| As rolled and cold treated —80°C., and drawn. | | | | | | | | | | |
| As rolled | 22,500 | 32,500 | 141,800 | 5.1 | 7.7 | 30-29 | 120 | 293 | 2700 | .127310 |
| C. T. —80° C. | 37,500 | 57,500 | 175,700 | 2.4 | 4.3 | 12-10 | 120 | 430 | 7040 | .128443 |
| Draw 400° C. | 50,000 | 75,000 | 200,000 | 5.1 | 9.6 | 10-7 | 120 | 444 | 7840 | .128545 |
| Draw 500° C. | 22,500 | 42,500 | 188,300 | 7.3 | 9.2 | 13-9 | 160 | 387 | 9540 | .128652 |
| Draw 600° C. | 17,500 | 45,000 | 158,900 | 14.1 | 34.3 | 20-16 | 221 | 321 | 8500 | .128819 |
| As rolled and drawn, without cold treatment. | | | | | | | | | | |
| Draw 400° C. | 22,500 | 30,000 | 143,200 | 8.5 | 11.5 | 39-37 | 160 | 277 | 2700 | .127130 |
| Draw 500° C. | 20,000 | 37,500 | 157,200 | 10.0 | 24.1 | 14-14 | 160 | 293 | 3240 | .127400 |
| Draw 600° C. | 30,000 | 42,500 | 166,100 | 7.5 | 10.4 | 17-14 | 160 | 332 | 9240 | .128773 |

**Effect of Cold-Treatment on Brinell Hardness of Nickel Steels**

| | Ni-Si Included for Comparison | | | | |
|---|---|---|---|---|---|
| Alloy No. | 18 | 19 | 20 | 21 | 23 |
| Carbon | 0.05% | 0.05% | 0.05% | 0.04% | 0.05% |
| Silicon | ..... | ..... | ..... | ..... | 3.83 |
| Nickel | 24.73 | 26.78 | 28.00 | 30.09 | 24.93 |
| As Forged | 163 | 121 | 89 | 95 | 163 |
| Cold-Treated —180° C. | 293 | 321 | 302 | 255 | 418 |
| Cold-Treated —180° C., Drawn 100° C. | 321 | 302 | 293 | 255 | 418 |
| Cold-Treated —180° C., Drawn 200° C. | 321 | 302 | 293 | 255 | 444 |
| Cold-Treated —180° C., Drawn 300° C. | 302 | 302 | 293 | 255 | 460 |
| Cold-Treated —180° C., Drawn 400° C. | 302 | 293 | 286 | 241 | 555 |
| Cold-Treated —180° C., Drawn 500° C. | 286 | 286 | 277 | 235 | 512 |
| Cold-Treated —180° C., Drawn 600° C. | 149 | 166 | 166 | 174 | 302 |
| Cold-Treated —180° C., Drawn 700° C. | 143 | 140 | 131 | 126 | 149 |
| Cold-Treated —180° C., Drawn 800° C. | 143 | 140 | 131 | 121 | 131 |

PRELIMINARY tests on steels containing approximately 18.00 per cent chromium with nickel varying up to 9.20 per cent indicate that alloys containing approximately 5 per cent nickel possess borderline characteristics, lying between the so-called martensitic and austenitic steels, and can be considerably hardened after rolling by cooling to a low temperature such as is obtained with solid $CO_2$. Results of studies along this line will be reported upon during the Metal Congress by G. V. Luerssen and O. V. Greene of the Metallurgical Laboratories, Carpenter Steel Co., in an A.S.S.T. paper entitled, "The Cold Treatment of Certain Alloy Steels."

A complete study was undertaken of the physical properties of both the 4 and 5 per cent nickel alloys after various treatments, some of which included cooling to —80 deg. C. (—112 deg. F.) developed several points of interest, particularly in connection with the 5 per cent alloy. In this respect the great increase in Brinell hardness from 277 to 444 following cold-treatment and suitable drawing is outstanding. This increase is accompanied by an increase in ductility and permeability with no drop in Izod values, suggesting some practical applications, particularly since parts may be hardened by this method without even surface discoloration. A marked improvement in machinability is produced by cold-treatment followed by a suitable draw. The cold-treatment is absolutely necessary to these changes, appears to have a permanent effect and in fact appears also to aid corrosion resistance.

Further studies of the effect of small variations in nickel content indicated a maximum of 5.10 per cent nickel for most effective hardening, with a permissible range of 4.7 to 5.1 per cent. Subsequent work upon an alloy of 5.08 per cent nickel was therefore conducted. No advantage was shown by cooling it to liquid oxygen temperature, indicating that the solidified $CO_2$ temperatures are low enough for all practical purposes. Results are shown in an accompanying table.

Appreciable increases in hardness were also obtained by cold-treating a group of alloys containing from 24.73 to 30 per cent nickel at —180 deg. C. (—292 deg. F.) in liquid oxygen. (Results in accompanying tables.) An alloy containing 3.83 per cent silicon and 24.93 nickel exhibited a much greater increase in hardness than an alloy of practically the same nickel content with normal silicon. This is particularly noticeable after drawing the cold-treated specimens to 400 deg. C. (752 deg. F.). The increase in tensile properties corresponds to the increased hardness obtained.

In order to obtain the controlled cooling and accurate temperature measurement essential to the study of these physical properties, it was necessary to devise a container capable of maintaining low temperatures within close limits and a thermocouple of greater accuracy at low temperatures than those commonly available. The container took the form of a low-temperature muffle, extremely simple in construction, and may give some lead to those planning to put the process to practical use. It consisted of a 14x14x21-in. wooden box with holes cut in the ends to allow the insertion of a muffle of 3-in. wrought iron pipe passing completely through the box. A rectangular tank, 11x11x16 in., of galvanized sheet iron, was placed in the box and surrounded on all sides and the bottom with a 2-in. layer of tightly packed asbestos fiber. The wrought iron pipe, after insertion, was soldered to the tank. The pipe had been drilled previously on one side to permit the insertion of lengths of pipe for thermocouple wells. A sliding wooden door was put at one end of the pipe and an adjustable damper at the other. With this system of ventilation, it was possible to keep the temperature to plus or minus 1 deg. C. throughout the whole temperature range of +10 to —80 deg. C. over periods as long as 8 hr. When the apparatus was to be used, alcohol and acetone were added in sufficient amounts to cover the muffle completely. Solid $CO_2$ in small lumps was added gradually until the required temperature was reached. Even at very low temperatures the evolution of gas kept the liquor in constant motion, insuring a perfect temperature. During use the top of the container was covered with a ½-in. abestos board which could be raised to permit the addition of $CO_2$. The usual iron-constantan thermocouple was replaced by specially built ones of bismuth-tellurium.

No experiments have as yet been performed upon other alloys or non-ferrous materials. These may show that cold-treatment will likewise improve their properties. The greater density of carbon dioxide gas over air and its greater specific heat, coupled of course with its much greater coldness when released from solidified $CO_2$, would cause it to cool much more rapidly material placed in it for quenching, because of the much more rapid heat transfer. Practical quenching means may be developed very soon to take advantage of this possibility where it will prove of value, and further experiments with metals at low temperatures may result in entirely new metal-treating processes which may require low-temperature quenching or at least cold-treatment.

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# A Welded Steel Grinder

A. W. FORBES
*Forbes & Meyers*

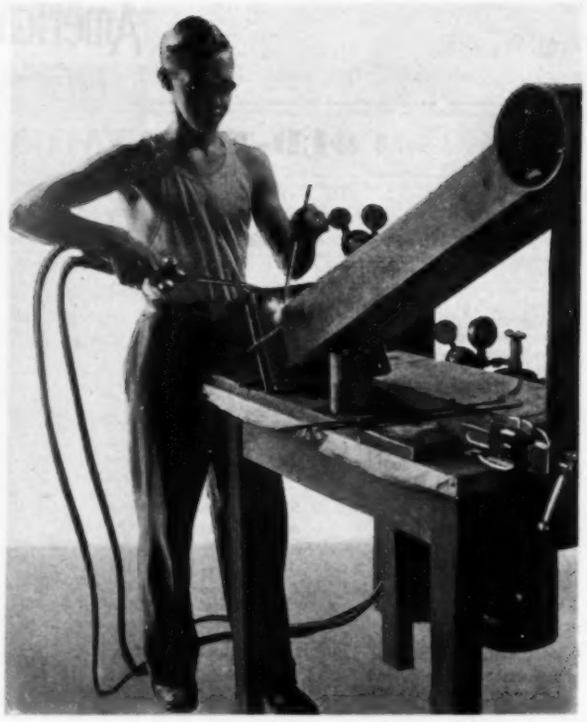
COST is the most important consideration in the question of substituting welded steel construction for castings. Cost made us decide to redesign a tool grinder to permit use of this method, since it was found that the main grinder frame could be built at a cost of less than half. Costs of some parts, such as the bearings, remained the same, but the total cost of construction of the new machine was 35 per cent below that of the old.

Castings have their advantages, the most important being weight (where this is desired), greater freedom from noise and vibration, and appearance. If welded steel is to be used, it is important that these factors be provided for. Noise and vibration depend more upon shape than they do upon material, so it should be possible to make a machine with welded frame that will operate just as quietly as a cast-frame machine. But in practice the welded frame is more likely to contain the large uniform surfaces that ring or that tend to exaggerate minor sounds. This grinder does produce slightly more noise than the cast one, but the difference is not enough to be important.

Appearance is the factor that has probably done more than anything else to check more general use of welded construction. Every designer, pattern maker and mechanic knows how to shape a casting to make it look well, but the curves so generally used in castings are not adapted to welding. The designer cannot make the machine the way he wants to make it, so he drops the question of appearance and designs for use only. The result is that many welded machines look as though they had been designed by an inexperienced boy. They never would sell. We have known for years that we could build a welded grinder cheaper than the ones we were making, but we were not satisfied that we could make one that would look well enough to sell in quantity.

As an example of the difficulties involved, we formerly made grinder columns tapered to a curve at top and bottom. These curves would cost so much if welded that they were out of the question. It was necessary to use straight lines, and it naturally seemed that straight parallel sides would be best. A machine was built that way, and the result was bad. Parallel lines may look well on some machines, but on this they did not look parallel; they made the machine look all out of proportion. Finally, a taper of 1 in. was decided upon, giving 8 in. width at the bottom of the column and 7 at the top.

**One of the simple fixtures required**



**Fabricating a welded steel tool grinder**

There is the question of the number of pieces needed for a column of this type. Ordinarily it would be assumed that one piece bent at three corners and welded at the fourth would be cheapest. Actually we found it cheaper to make the column of four pieces welded at all four corners. The welding process is quite cheap, and cutting is greatly simplified by making the sides separate. The base is also made of four pieces of steel sawed from the bar and welded together.

These can be welded with either the acetylene or electric arc. Each has its place, and for most efficient production both should be available. The four pieces at the base of the column are heavy enough so that the electric arc is cheaper. The corner of the column, of thin steel, can be welded by either process with no material difference in cost. Where the lighter sides of the column join the heavier material at the base, we think the acetylene preferable. In this case we use a copper fillet which is of ample strength, and which makes a first-class weld with steel. There is not the danger of burning through the thin section, and there is not so much strain on the metal as would be the case if a heavy fillet were built up with the electric arc. A similar copper joint is made at the top of the column where it joins the motor casing.

A few simple fixtures are required. One of these is shown. It consists of a plate of steel with guides for locating the four pieces for the base, and a vertical rod with adjustable screws for holding the column perpendicular to the base. The four base pieces are first welded. Then the column is placed over the guides and the whole fixture inclined to the most convenient angle for placing the copper fillet. The base pieces are held with clamps, but nothing is required to hold the column.

When it is finished, we have a machine that costs but two-thirds as much as the former unit, and which will do just as good work, give just as much power, and have just as long a life.

# AMERICAN MACHINIST

*Editors* KENNETH H. CONDIT AND FRED H. COLVIN

**New York, September 17, 1931**

VOL. 75 No. 12


## National Metal Congress

Comes the thirteenth National Metal Congress during the week of September 21, and with it the National Metal Exposition. Boston is to be host to the thousands of visitors to this important assembly and exhibit sponsored by the American Society for Steel Treating and four other great cooperating societies, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Welding Society, and the Society of Automotive Engineers.

As proof positive of our sincere desire to cooperate most effectively, we have assembled in this issue a group of articles calculated to interest and inform every attendant at the joint affairs without dulling the fine edge of anticipation and surprise.

## Facing Facts

Casual reading of the newspaper reports of the Labor Day speeches of labor leaders indicates the existence of a determined campaign for a five-day work week of six-hour days. Unfortunately, there is little indication of any change in the union policy of fighting the introduction of labor saving machinery that has made possible the earning of a living on any such reduced time basis.

If this one difficulty could be cleared up there would be every reason for machinery and equipment manufacturers to lend their hearty support to such a campaign. Looking ahead to the time when we shall be working hard to make up for the deferred maintenance, the deferred buying of luxuries, the deferred demand for some product that is yet to be invented, two alternatives will present themselves. We can either revert to an eight-hour or seven-hour day, or to a longer work week, or we can install more machinery to multiply man power, and thus stay on short time.

The facts are that our present machine capacity is beyond the demand of a fear-paralyzed consuming public, that a shorter work period is unavoidable under present conditions, that a workman without adequate equipment to aid him cannot earn a living on the reduced time basis. When we face them fairly we shall be far nearer prosperity than we are now.

## Policy

Up in Westchester County, New York, lives a man who resolved to buy an oil burner for his furnace. Just a few days ago he telephoned the local branch office of a large oil burner concern, and in due time a salesman called. They inspected the furnace and basement together.

"We'll place the tank here in this corner of the basement," said the salesman.

"I don't believe so," said the man. "I'd much prefer to bury it out under the driveway."

"Can't do it," said the salesman. "Too much work. Too much rock here in Westchester."

"But I'm sure we can. We didn't have to blast for this basement. Anyway we can dig a couple of test holes to see."

"Nope," said the salesman. "Our policy is to put the tank in the basement."

"Good day," said the man.

This story may not have a moral, and yet there must be one because it confirms certain impressions of other you-buy-my-way-or-I-won't-play sales policies still cluttering the way to business recovery. One can at least suggest that every shop executive and operative has a right to insist that his own company's sales policy be scrutinized and revamped to meet present day conditions before any ukases announcing further cuts in salary or hours are issued.

### Foremen Who Antagonize

Times like these are propitious for checking up on your minor executives and ocasionally on some of the higher-ups. When jobs are hard to find, signs of insubordination among employees are good indications that something is probably wrong with those over them. When a workman will risk his job under present conditions it is high time to check up on his foreman; the chances are that he is not the man for the place.

The foreman who provokes outbreaks of resentment at any time is a liability. At such a time as this, he is a menace to morale and consequently to production and profits.

## ◂◂ CHIPS ▸▸

Hard to say just what is the best news of the week . . . probably hard to beat the twin facts that vacations are over and that we are getting to work again . . . loadings of revenue freight again show increases . . . According to the vice-president of International Tel. and Tel., who has just returned from a swing around the country, optimism reasserts itself in every large city except New York City, Pittsburgh and Detroit . . . And it is not unlikely that business men in the latter two are emulating New York by still keeping far too sharp a weather eye on Wall Street . . . "There ought to be a law."

National Machine Tool Builders Association reports gross order index of 71.7 against 61.5 in July . . . Rumor that Sullivan Machinery Company is restoring all wages and salaries to pre-cut standards . . . 6,000 employees affected.

Well authenticated rumor that E. I. du Pont de Nemours is backing Remington Arms in the purchase of Winchester . . . Another that some steel company is spending eight million to outdo A. O. Smith on pipe welding . . . Working on resistance principle rather than arc . . . More automobile manufacturers threaten to invade the five hundred dollar class . . . Still another backshop returns to work—the Cheyenne shops of the Union Pacific . . . Shipments of Auburns and Cords total 1,803 for August, as against 609 last year . . . Retail sales of all automobiles in August total 180,000, compared with total production of 157,000 . . . Good thing that Ford is putting 15,000 more men back to work . . . Probable that there will be 50,000 more Model A's before a change . . . Underwood Elliott Fisher reopens with 2,700 workers.

#### MAGNESIUM THE PLENTIFUL

In 1915 the average price for magnesium metal was five dollars per pound; last year around eighty cents. Because magnesium alloys are the lightest available and probably the easiest of all metals to machine, the new prices announced by Dow Chemical Company, Midland, Michigan, would seem to merit more comment than a market report. Thirty cents per pound in car load lots, thirty-two less than car load, should decide many a manufacturer to specify them in his products. Contrary to the opinion of many, magnesium is one of the most plentiful elements in the earth's crust; potential production facilities are ample to satisfy almost any demand. There is scientific and production drama behind the change from five dollars to thirty cents, and the principal producers are to be congratulated for their foresight and energy.

All who still insist on watching Washington will find a number of things . . . Surplus cotton is to be sold to Europe . . . Already 200,000 tons of surplus U. S. wheat have been sold to Germany on long term credits . . . U. S. Chamber of Commerce drops National Business Survey Conference with thanks to the twenty members and hardly that . . . Administration shows unexpected resistance to proposed American Legion raid . . . Announces U. S. gold stock totaling over five billion, nearly one half of world's monetary gold . . . Is that the basis for Babson's prediction that commodity prices will rise in the near future?

Best to keep fingers crossed on Doherty's five hundred thousand offer to the A.S.M.E. for a job plan . . . There seem to be some strings not hitherto noticed . . . At that, any plan to solve the unemployment riddle would seem preferable to those of Green, Murray, Borah, Reed, Woll et al . . . not forgetting the American Legion.

Tragic both for the aviators and the aviation industry that Moyle and Allen should be lost on their flight across the Pacific . . . Meanwhile the Graf Zeppelin returns home safely from South America . . . Food for thought in both facts . . . Wilkins returns safely to base after voyage under ice pack . . . Schneider Cup record soars to 340.8 miles per hour . . . 404.27 m.p.h. for three kilometer straightaway . . . highest speed yet attained by man . . . Schneider Cup won in 1913 at 45.75 m.p.h.

Rumor that Amtorg seeks to float five hundred million dollar loan . . . Flotation almost assured of success by record of payments to American manufacturers to date . . . Purchasers of discounted Amtorg bills have made a clean-up . . . Canadian National Railway bond issue of twenty-five million dollars oversubscribed as expected . . . Cowardly capital passes by thousands of industrial bonanzas for a measly four and one half per cent minus . . . And flags are flying for American Constitution Day today.

"A man is known by the company he keeps and a company is known by the men it keeps."

England continues to face and solve realities . . . Let all bears on America's future scan the proposed British budget . . . Income taxes for married men earning five thousand dollars will be sixty times as great as those in America . . . for single men, one hundred times . . . A single man with an income of eighteen hundred dollars will pay three hundred fifty plus!

THIS WEEK IN *AM*

So insistently have we hinted at and alluded to the material in this issue of September 17, that almost any reader will be relieved to know that it is all here. The National Metal Congress and Exposition can now go ahead without further ado.

Paradoxically, the leading article stresses cold-treatment rather than heat-treatment. But if you do not already have full knowledge of what "Dry-Ice" promises to do in the preservation of the effects of annealing, you will be wanting to turn back and read "Cold-Treating Dural with Solid $CO_2$." Annealed rivets can be preserved for days without air-hardening. Then, if you want to see how cold-treatment will improve the physical properties and workability of certain alloy steels, seek out the Reference Book Sheet (page 473).

For more orthodox heat-treaters who have no hankering for cold-treating, we recommend certain data to be found in "Super High-Speed Steel" (page 451) by J. M. Highducheck, of Westinghouse Electric & Manufacturing Company. "Wage Incentive for Nitriding," by R. W. Gray of the same company, will also be found to hold some genuine pointers (page 458).

Welding is particularly well represented with three informative articles. C. L. Eksergian, welding expert, Budd Manufacturing Company, has been persuaded to give us a critical survey of all the automatic electric welding methods used in the manufacture of Budd automobile wheels. You will find more what, why and how here than you have read in many a moon (page 459). "Welding Fire-Box Sheets in Large Boilers" shows how it is done in the Roanoke Shops of Norfolk & Western (page 442). Incidentally they are welding the largest sheets of steel ever rolled. A. W. Forbes, of Forbes and Myers, presents the low-down on the manufacture of "A Welded Steel Grinder" (page 474).

And since shopmen, foundrymen, forgemen, pressmen, and other equally important factors in the industry might feel that too much of the issue has been devoted to comparative newcomers, Chester B. Lord, associate editor, presents "Working with High-Chrome Steels" (page 455). Never has his long and varied experience shown to better advantage than in this timely study of "stainless." We would like to hear, too, your side of "Iron and Gold," the Executive Forum topic for the week (page 444).

## • COMING •

Several months before Majestic refrigerators became an actuality in a constantly growing market, we began to hear rumors that certain parts were to be produced in "tenths." Some of us were inclined to shrug our shoulders and voice an unmistakable "Yeah?" Well, the fact is that Grigsby-Grunow has gone ahead and done it. Part after part is held to toolroom tolerances. "1500 Units a Day" will describe it in the next issue.

One day last spring, John Carmody, editor of "Factory and Industrial Management," took boat for red Russia. Though he travels thousands of miles per year in the interests of his magazine, this time he bore the portfolio of special investigator for the McGraw-Hill Publishing Co., publisher of *American Machinist*. His findings have been embodied in two articles, the first of which will apear in the next issue under the title of "Men and Machines in Russia." If you are looking for facts rather than fantasies, prepare to find them here.

Issue after next, we believe we have something of basic interest to every manufacturer in the field. There are enormous possibilities in "Educational Orders," and Congress must recognize them during the coming session.

# Progress in Metal-Working and Machinery Markets

**MACHINE TOOL markets continue to mark time . . . Some districts had upturns in inquiries, fewer had upturns in sales, but the general trend has still to assert itself . . . It is, of course, rather close to Labor Day to expect much increase in activity, and this fact holds some elements of cheer for dealers and manufacturers who are becoming sincerely disgusted with a situation that simply drifts without leadership . . . N.M.T.B.A. indexes show a bettering of the July low . . . Gross orders raised from 61.5 to 71.7 for August, almost equalling June's 73.6 . . . The 3-month average dropped, however, to 68.9 from July's 74.1 . . . Class C plants (0-$10,000 shipments average 1922-24) had an index of 105.1, highest by some 30 points of the three classes and up 40 from last month . . . The index of shipments rose from 92.2 to 95.7; the index of unfilled orders dropped from 202.3 to 181.6.**

**NEW YORK has as yet heard no further news on the Lycoming order, has some improvement in inquiries, and plenty of optimism, though little concrete has as yet appeared to support it . . . Detroit had only slight improvement during September and autumn prospects are not too pleasing unless the automobile business should show a sudden advance . . . Cincinnati manufacturers in some cases had sales increases, while dealers held about even and developed some new prospects. . . Some inquiries there and in New England are from the automotive field . . . New England also has a number of foreign and government prospects. Indianapolis is selling some small equipment to radio factories and some heavy machinery to coal fields.**

**CHICAGO business in machine tools continues at the same low level, although some improvement in inquiries for small tools has occurred . . . Used tools there, as in other districts, are going very slowly, even at give-away prices . . . Milwaukee optimists predict improvement in October, with automotive and electrical inquiries . . . Canada has little to offer, though industrial activity is up.**

## NEW YORK

Final orders for the Lycoming tools have not yet been released and may be slightly different from the original lists, hence no accurate total can as yet be given. Otherwise the market is quiet, although some improvement in inquiries is noted, more optimism is in evidence, and good business is expected within the next several months. The Schenectady school job, in which some dealers here were interested, has been closed, the entire list going to one supplier, according to reports. One New York dealer got a cutter grinder from it. A milling machine is included on a Department of Water Supply list closed Sept. 14. Nothing has yet been done on the Subway or Navy lists.

## DETROIT

Slight improvement has been recorded during September. Sales have increased a little and inquiries have shown a more decided advance. Thus far, autumn prospects are not particularly pleasing. Some orders are being received but these do not indicate any lifting of the general level of business. For the most part they represent replacements. There is little indication that the automobile business will show a sudden advance, and if it does not, total sales of machinery and machine tools for the year will be considerably below last year. That will mean that 1931 will probably be the poorest year in the last 15.

## CINCINNATI

A few machine tool manufactures had a very slight increase in sales following Labor Day, but with the great majority the market remained static. Selling agents had a modicum of business and had some success in locating users who showed interest in new equipment.

Principal buyers were general machinists and miscellaneous users whose orders were limited to one item. Some manufacturers received an increased number of inquiries, a few of which came from the automotive field, the remainder being from miscellaneous users.

## NEW ENGLAND

Inquiries have been the only indication of September improvement to date. This has, at least, added cheerfulness to the situation. Reports however, are no worse than any recent week, generally speaking, files showing the usual sprinkling of one-machine orders. Among new prospects are a number of automotive companies and the government. Foreign anticipations continue to run high, but no action developed this week. Figures have gone forward on the latest batch of government inquiries, which include quotations on automatic screw machines, engine lathes and grinders.

## INDIANAPOLIS

Little change is seen in demand for machine tools. Some small equipment is being sold to radio cabinet manufacturers and also to some of the radio makers but a lot of this equipment already was bought. Production in these plants is said to be good and likely will continue good for some time. Some heavy machinery is being sold in the coal fields. The railroads and steel makers are buying but little and that is purely for emergency purposes. Automobile demand is spotted. Chrysler appears busiest, judging from purchases and reports. Piston ring manufacturers have placed some orders.

## CHICAGO

Business in machine tools thus far in September continues on the same low level that has prevailed for the last several weeks. It had not been expected, however, that there would be any perceptible improvement for the first half of the month, therefore no expressions of disappointment have been heard from those whose optimism saw a pick-up. No definite information regarding lists likely to materialize in the near future is available, rumors to that effect being difficult to trace. A slight improvement is noted in inquiry for electric drills and small tools. Continued dullness prevails in used tools.

## MILWAUKEE

No marked improvement has as yet been noticed in sales of machine tools, although optimists predict that a change for the better will start soon with the upturn more noticeable in October. Current sales are few and principally for replacement. Inquiries have brightened the outlook from automotive and allied industries as well as electrical manufacturing concerns. Not much more business is expected from schools, while railroads are doing only a little hand-to-mouth buying. August was the low spot of the year.

## CANADA

The summer dullness is gradually giving way to a period of greater industrial activity, though this has not as yet been translated into any substantial stimulation of buying in the machinery and machine tool market. The automotive trade is still slow, with only a slight upturn in demand for parts and accessories. General foundrymen are but partially employed, and the bigger buyers, such as car and engine works, are not in the market in any large way, and are not likely to be for some time yet as the two major railways have given no indication of departing from their retrenchment policy adopted at the beginning of the year. Most of the steel mills are still working on reduced schedules, although the plants of the Dominion Steel and Coal Corporation are reported to be running at a favorable rate. Sales of general hardware are on the increase, and there is a pick-up in electrical appliances.

# WEEK . BY . WEEK

## BUSINESS BAROMETER

### Trends in General Business throughout the world

**THEODORE H. PRICE**
*Editor, Commerce and Finance, New York*

Labor Day is probably the most useful holiday we celebrate in the United States. It gives the industrialist opportunity to put his organization and his tools in order, and marks the beginning and the end of a farmer's calendar, which is pre-historic in its origin. Therefore, it is quite natural that on the first Monday in September some attempt should be made to discern the probabilities of the future as well as to scan the achievements or mistakes of the past. This disposition to examine the past and forecast the future has found expression in the thousands of letters, articles, reports, prognoses and diagnoses upon the economic situation in this country and Europe that have recently been published in the newspapers and magazines.

It seems hard to believe that any group of civilized men would abandon themselves to melancholy as have the American public during the last ten days, but there is no doubt that most people are blue, and that they find a sort of satisfaction in surrendering themselves to the pessimism that is now so general.

The only antidote for it is to be found in the proverb which declares that the expected rarely happens, and that those who rely upon its occurrence are generally disappointed by developments that are not as depressing as the pessimists predicted. To this rule the present and the recent past do not seem to be exceptions, for despite the gloomy reports and prognostications that are to be found in the papers, we can also discern here and there an optimistic article which attracts a little attention among those who are willing to be convinced that the present melancholy is not permanent, and that we will emerge from the troubles that now oppress us just as we have done in the past.

#### Incorrect Conclusions

This conclusion seems to be warranted by the history of the past, of which we all are becoming members from day to day. Therefore, it is becoming evident that we shall have to re-interpret economic law or forswear many of the conclusions that we have drawn from it during the last two or three years. One of these conclusions is the rule which leads us to expect that an oversupply of money and particularly of gold, will cause inflation. Ten years ago everybody who knew anything of the subject would have subscribed to this belief. Now the United States holds fully five billion dollars, or 45 per cent of the world's supply of monetary gold, without causing any perceptible inflation. This is inexplicable to the inflationists. No one has yet been able to reconcile it with the economic theories that we previously accepted as impeccable.

Then there is the great volume of credit that has been brought into being by the Federal Reserve System, and the banks identified with it. During the six months ending June 30, 498 banks in the United States lost their identity as a result of consolidation, purchase, or merger with some other bank or banking institution. Of course, the deposits of these merged or absorbed institutions were also absorbed. But there has been no great pressure to make loans, and none of the characteristics of inflation have been noticeable in the United States.

Then there are the savings deposits. In the State of New York alone the savings banks hold three and one-half billions of the depositors' money. This is about one-third of the total banking resources of the State. Interest rates have recently been reduced from 4½ per cent to 4 and 3½ per cent per annum, but this reduction does not seem to have had much effect upon the inflow of the capital saved by the masses, and one prominent New York savings bank has issued a circular urging its depositors who have accumulated a moderate sufficiency to spend their money wisely rather than to save it.

#### Financial Wonderland

These are just a few of the items which have led a New York banker to assert that we were in a sort of financial wonderland, where many strange financial developments were pending. Certainly there is some reason to doubt whether all that we see is real and to be depended upon in making our plans for the future. But, however we may argue, it is plain that in the United States at least we suffer from a plethora of capital, of which Great Britain and the various states that make up the British Empire are sorely in need. Therefore we seem to have acted wisely in assuming our share of the loan that has been negotiated by the British Government with the Bank for International Settlements in Europe and the banks and bankers of the United States.

The suggestion that such a loan lacks security seems to be almost absurd to those who can recollect our experience in 1896, when the late J. Pierpont Morgan was described as "saving the United States Treasury" from bankruptcy by supplying it with one hundred million dollars in gold.

In this connection it would also be well to read the chapters in our financial history which describe the difficulty that this country had in selling its 7 per cent bonds to pay the expenses of the Civil War, and maintaining the gold reserves required when it was feared that Bryan would be able to secure the re-monetization of silver.

Our success in thus withstanding the strains put upon a Government whose financial stability remained to be proven is presently reassuring, and deepens the conviction that the present depression will prove but temporary.

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*95 Broad St., New York*

## THE BUSINESS WEEK

*September 17, 1931*

**Slight but belated signs of the autumn acceleration of activity appeared in the pre-Labor Day week . . . Railroad movement of merchandise freight at last turned upward after a depressing period of persistent decline . . . Check payments gave some promise of responding to seasonal influences . . . Building contracts also improved from the disappointing early August level . . . Our index, after touching new lows in the middle of the month, rallied a little . . . Steel activity and power production alone reflect uncertainty about the extent of the usual Fall flurry . . . Though the seasonal turning point has passed, business is still not sure where the street leads . . . Fundamentally reassuring are the relative stability of commodity prices in face of burdensome surpluses, and the progressive weakening of the successive waves of reaction to unfavorable news in the security market, as the forces of deflation wear themselves out . . . While the ultimate issues in the European situation are still in suspension the immediate emergencies seem to have been successfully handled . . . On the whole it is not unreasonable to assume that, until the cacophony of the coming Congress fills the atmosphere early in December, the field will be clear for some seasonal increase of activity and convalescence of confidence this fall under the harvest moons of the next three months.**

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# Material Trends and Prices . . . .

Recovery from slackness of last week's holiday period represents no actual gain of business in the metals industries. Steel prices appear to have struck a level at which resistance is offered to further reductions. Ship plates, automotive material and rails are moving faster than are most of the other forms of steel. A slight recovery is noted in scrap prices. Demand for both tin and lead shows improvement, while that for zinc remains small. The copper market reflects uncertainty.

*(All prices as of Sept. 11, 1931)*

## IRON AND STEEL

| Pig Iron— | Current | Mo. Ago | Yr. Ago |
|---|---|---|---|
| Birmingham, No. 2, Fdry., per gross ton | $12.00 | $12.00 | $14.00 |
| Buffalo, No. 2, Fdry., per gross ton | 17.00 | 17.00 | 15.90 |
| Heavy Melting Steel Scrap— Pittsburgh consuming point, No. 1, per gross ton | 10.50 | 10.50 | 15.60 |
| Furnace Coke—Connellsville, per net ton | 2.40 | 2.40 | 2.60 |
| Foundry Coke—Connellsville, per net ton | 3.25 | 3.25 | 3.50 |
| Steel Shapes—Pittsburgh, base, per 100 lb | 1.60 | 1.60 | 1.60 |

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**Iron Machinery Castings**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb:

| | | | | | |
|---|---|---|---|---|---|
| Chicago | 4.62½ | Cleveland | 4.50 | New York | 4.75 |
| Cincinnati | 4.40 | Detroit | 4.00 | | |

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**Steel Sheets**—Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

| | Pitts. Mill | Chicago | Cleveland | New York |
|---|---|---|---|---|
| Blue annealed, No. 10* | 1.85 | 3.20 | 3.00 | 3.40 |
| Black sheets, No. 24 | 2.40 | 3.55 | 3.60 | 3.50 |
| Galvanized, No. 24 | 2.90 | 4.10 | 4.00 | 4.00 |

* Light plates.

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**Seamless Steel Tubing**—Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

| Thickness of Wall | | Outside Dia. in Inches | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | ⅜ | ½ | ⅝ | ¾ | 1 | 1¼ | 1½ |
| Inches | B.w.g. | Price per Foot | | | | | | |
| .035 | 20 | $0.15 | $0.16 | $0.17 | $0.18 | $0.19 | $0.21 | $0.23 |

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**Shapes, Plates, Bars, Etc.**—Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Bands | 3.40 | 3.00 | 2.95 |
| Bars, soft steel | 3.10 | 2.75 | 2.75 |
| Cold fin., flat or square | 3.90 | 3.60 | 3.60 |
| Cold fin., round or hexagon | 3.40 | 3.10 | 3.10 |
| Cold rolled strips | 4.95 | 6.00 | 5.50 |
| Floor plates | 4.85 | 5.00 | 5.00 |
| Hoops | 3.75 | 3.65 | 3.50 |
| Rivets | 4.00 | 4.00 | 4.00 |
| Shapes | 3.10 | 2.95 | 3.00 |
| Spring steel | 4.00 | 4.00 | 4.00 |
| Tank plates | 3.10 | 2.95 | 3.00 |

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**Stainless Steel**—Hot-rolled bars, base, Pittsburgh 0.12 per cent carbon, cents per lb:

| Chromium | | Chromium | |
|---|---|---|---|
| 15% and under | 19.00 | 18 to 23% | 23.00 |
| 15 to 18% | 20.50 | 23 to 30% | 28.00 |

**Bolts and Nuts**—Discount from list, f.o.b. mills, Birmingham Chicago, Cleveland and Pittsburgh, on machine bolts, all sizes, cut thread; nuts, hot-pressed or cold punched; and lag screws, mill lots ..... 73-10%

## NON-FERROUS METALS

| Prices following are in cents per lb. for mill shipments in carlots: | |
|---|---|
| Aluminum ingots, 99%, N. Y. | 23.30 |
| Copper, electrolytic, Conn | 7.50 |
| Copper wire, base, Chicago and Cleveland | 9.87½ |
| Copper wire, base, N. Y. | 9.75 |
| Lead, pigs, E. St. Louis | 4.22½ |
| Tin, Straits, pigs, spot, N. Y. | 26.00 |
| Zinc, slabs, E. St. Louis | 3.80 |
| **Prices following are in cents per lb., base, N. Y., Chi. and Cleve:** | |
| Brass rods, high | 13.62½ |
| Brass sheets, high | 15.37½ |
| Brass tubing, high | 20.25 |
| Copper, drawn round | 16.12½ |
| Copper sheets | 17.62½ |
| Copper tubing | 20.12½ |
| **Prices following are in cents per lb., del. from N. Y. warehouse:** | |
| Babbitt, anti-friction, general service | 29.00 |
| Babbitt, com'l, intermediate grade | 34.75 |
| Babbitt, genuine, highest grade | 44.50 |
| Solder, bar | 19.87½ |
| **Prices following are in cents per lb., base, Huntington, W. Va:** | |
| Monel metal rods, hot rolled | 35.00 |
| Monel metal sheets, full finished | 42.00 |
| Monel metal tubing, seamless | 65.00 |
| Nickel rods, hot rolled | 45.00 |
| Nickel sheets, full finished | 52.00 |
| Nickel tubing, seamless | 75.00 |

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**Scrap Non-Ferrous Metals**—Dealers' purchasing prices in cents per lb., f.o.b. cars:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Heavy yellow brass | 3.00 | 4.25 | 4.00@4.25 |
| Light brass | 2.50 | 3.25 | 3.25@3.75 |
| No. 1 rod-brass turnings | 3.50 | 4.50 | 4.00@4.50 |
| Heavy copper | 5.75 | 5.75 | 6.25@6.75 |
| Light copper | 4.50 | 5.00 | 5.50@6.00 |

## SHOP SUPPLIES

| (Prices at warehouse) | New York | Cleveland | Chicago |
|---|---|---|---|
| Abrasive disks, aluminum oxide mineral, cloth, 6-in. dia., No. 1, less than 200, per 100 | $4.36 | $4.59 | $4.59 |
| Belting, leather, heavy, discount | 30-10% | 40% | 40% |
| Belting, rubber, trans., 1st grade, discount | 60-10-10% | 60-10% | 60% |

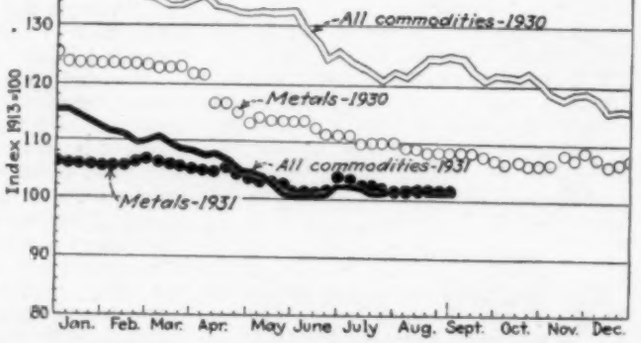
Lumber—Per M ft., b.m., 16 ft. lengths, del., N. Y:

Crating—Southern pine:

1x4-in. ..... $27.00 1x6-in. ..... $26.00

Skids—Spruce:

2x4-in. .$37.00 3x3-in. .$46.00 4x6-in. .$48.00 6x6-in. .$52.50




**Price Indexes Week by Week**

**(6 *Metals* and 74 *Commodities*—*Figures from The Annalist.*)**

# NEWS

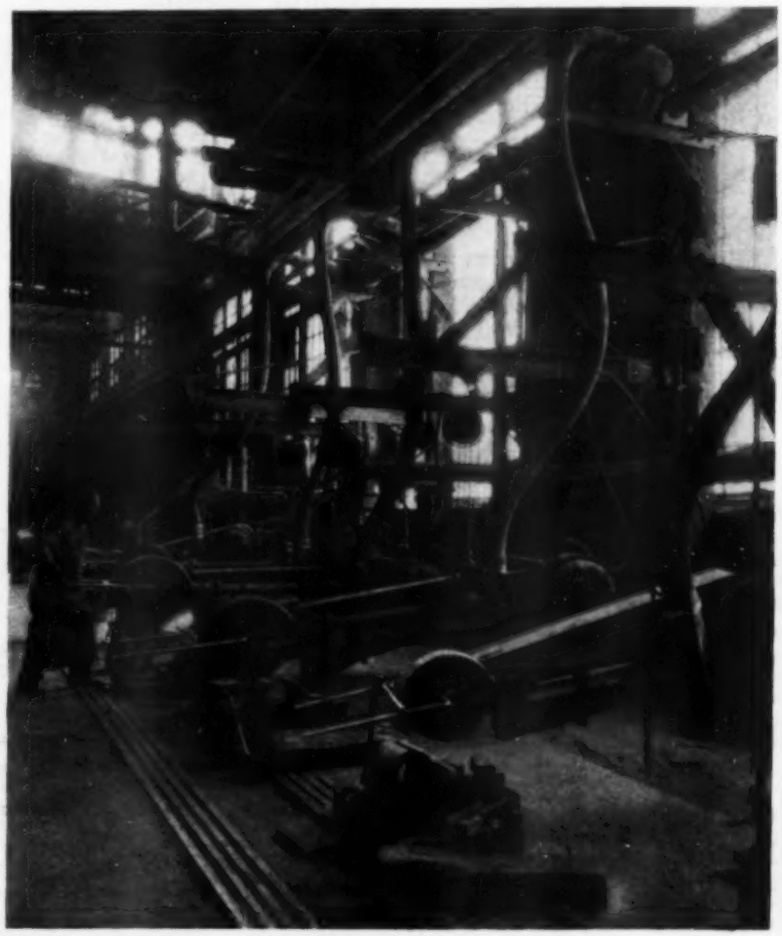
## Metal Congress and Exposition Next Week at Boston

Next week will mark the Thirteenth National Metal Congress and Exposition, being held this year in Boston. Not since 1914 has either Boston or New England been host to a group of this sort. Included in the groups holding meetings during the week are the A.S.S.T., A.W.S., Iron & Steel and Institute of Metals Divisions of the A.I.M.E., Iron & Steel and Machine Shop Practice Divisions of the A.S.M.E., and for the first time this year the Iron & Steel Division of the S.A.E. standards committee. Most of the groups will register at the Hotel Statler; the A.S.S.T., however, will have its registration desk at Commonwealth Pier where the Exhibition will be held, although headquarters will be the Hotel Statler, and Welding Society members will register at the Copley Plaza. Technical sessions will be held each morning and afternoon, the A.S.S.T. leading with 56 papers and ten sessions, the A.W.S. having 19 papers and several committee reports at seven sessions, the A.I.M.E. having 24 papers and six sessions, and the S.A.E. and A.S.M.E. each having three papers at one session. Complete technical programs have been printed previously in *American Machinist*, and papers of most interest to our field have been abstracted in this number.

The A.S.S.T. program is increased this year by 44 per cent, and a 50 per cent increase in exhibit space sold is also reported. Exhibits will cover 60,000 sq.ft. on Commonwealth Pier, and more than 75,000 engineers and executives are expected to visit them during the Congress. The Exposition will be open throughout the week from noon to 10 p.m., except on Sept. 24, when it will close at 6 p.m. The social side will be considered also by three of the societies. The A.S.S.T. will hold its annual banquet Sept. 24 at the Statler, where the President's Medal will be presented to ROBERT G. GUTHRIE, 1930 president, and the Henry Marion Howe Memorial Medal will be awarded. The A.I.M.E. divisions will also dine together on Sept. 24, also at the Statler, with a non-technical talk on molybdenum heading the program. The A.W.S. will hold its annual banquet on Sept. 24 also, with a dance following it, both to be held at the Copley Plaza.

## Drop Forgers Hold Round-Table

An innovation in meetings was that of the American Drop Forging Institute at Cleveland recently. D. A. CURRIE, vice-president and general manager of the Erie (Pa.) Foundry Co., listed on the program for an address on motor-driven hammers, appeared instead with a list of questions which he submitted to the 70 practical forge shop operators gathered for the meeting. Mr. Currie, a drophammer builder, asked for information on the group's preferences in design, among them the question of length of stroke, variable-stroke, two-stroke and belt-driven vs. motor-driven hammers, cost reduction through standardization, greater convenience in die changing, etc. The interest and discussion were so great that only about half the questions were gone through, and the remainder will be discussed by questionnaire. Discussion brought out that the tendency is toward shorter strokes and heavier rams, this aiding in increasing strength, durability and rigidity of the hammer. Preference was expressed for two-stroke over variable-stroke hammers. R. T. HERDEGEN of the Dominion Forge & Stamping Co. requested a better method of rating presses. C. H. SMITH, president of the Institute, opened the meeting with an address on "The Association—What it Can Mean to You." JUDGE LEE E. SKEEL, president of the Cleveland Safety Council, discussed the importance of safety work, and P. P. GOTT, manager of the Trade Association Department, Chamber of Commerce of the U. S., discussed the aid of trade associations to industry. Other speakers included W. E. JOHNSTON, president of the Johnston Mfg. Co., talking on combustion, and MARC A. ROSE, managing editor of *The Business Week*, speaking on, "Must We Have Depressions?"



**Removing fins and spines from steel castings at the Schenectady G.E. plant. The machines are connected to swing ventilators, the flexible exhaust system being carried to the motor-driven grinders by five jib cranes.**

## Swope Urges Economic Control

Control of economic forces through the emancipation of both labor and industry was urged last night by GERARD SWOPE, president of the General Electric Co., at the annual dinner of the National Electrical Manufacturers Association at the Hotel Commodore. Addressing 600, Mr. Swope declared that industry must act to forestall legislation threatening the fundamental structure of American business and the cherished ideals of American society.

Discussing "Stabilization of Industry," Mr. Swope pictured industry as shackled with restrictions which prevent control of production, and labor as fettered by disadvantages commonly visualized in "the 40-year dead line." Mr. Swope proposed a new constitution for industry, which, he suggested, promises lasting relief from "hard times." His plan, worked out in detail, contemplates the stabilizing, first, of production and consumption, and, second, of employment. Mr. Swope's whole speech should be read in full.

CLARENCE L. COLLENS, president of the Association, and of the Reliance Electrical & Engineering Co., presided at the dinner. The other speakers, who discussed the plan put forward by Mr. Swope, were: A. W. ROBERTSON, chairman of the board of the Westinghouse Electric & Mfg. Co.; J. H. TRUMBULL, president of the Trumbull Electric Mfg. Co. and former Governor of Connecticut; OWEN D. YOUNG, chairman of the board of the General Electric Co.

## Schiess-Defries Director Arrives

E. BERNDT, technical director and vice-president in charge of production and sales, Schiess-Defries A.G., Düsseldorf, Germany, arrived last week on the *Europa* to spend a month in the United States observing outstanding engineering achievements and studying the market for the lines of special and heavy-duty machinery built by his company which do not compete with American tools. Schiess-Defries, established in 1866, is the oldest machine tool firm in Germany and employs 3,000 men in the shops and an engineering staff of 300. Thanks partly to heavy Russian orders, the plant is now running at 100 per cent capacity. Mr. Berndt is accompanied by ULRICH KAUERMANN, his American representative, whose address is 602 Fountain Square Bldg., Cincinnati. This address will be used by Mr. Berndt while he is in the United States.

## Reports Optimism All Over Country

Optimism has begun to reassert itself in every large city of the country except New York City and possibly Pittsburgh and Detroit, according to MAJOR GEN. GEORGE S. GIBBS, vice-president of the International Telephone & Telegraph Co. General Gibbs based his observations on an extended tour of the United States, exclusive of New England. He talked with leading bankers and publishers in 30 different cities and everywhere was informed that conditions in those cities were not as bad as they were in New York City.

Better conditions in California and the far west in the middle and eastern sections are reported by R. T. MESKER, secretary of Aluminum Industries, Inc., Cincinnati, Ohio, who has been spending the last six weeks in that section, dividing his time between the company's warehouse branches at Los Angeles and San Francisco. While automobile sales have slumped steadily, conditions in the parts industry show a healthier trend and parts jobbers are optimistic, according to Mr. Mesker.

## 15,000 Ford Men Back at Work

Between 15,000 and 20,000 former employees of the Ford Motor Co. went back to work Sept. 3. Ford officials planned to have 50,000 men at work by Sept. 15.

## Freight Loading Continues Up

Loading of revenue freight for the week ended Aug. 29 totaled 763,764 cars, the Car Service Division of the American Railway Association has announced. This was an increase of 15,053 cars above the preceding week but a decrease of 220,746 cars below the corresponding week last year.

## Cincinnati Miller Makes Appointments

J. E. CASTER, S. E. BERGSTROM and R. E. FIELD have been appointed to manage the newly-opened Cleveland, Detroit, and Chicago offices of The Cincinnati Milling Machine Co. and Cincinnati Grinders, Inc., Sales Co. Mr. Caster went with the Cincinnati Acme Tool Co. as draftsman and machinist upon graduation from Purdue University. He became affiliated with the Cincinnati Milling Machine Co. in 1916 as tool designer and engineering specialist. Associated with Mr. Caster in the new Cleveland office, with headquarters at 5005 Euclid Ave., in the Euclid Windsor Bldg., will be J. G. MOOHL, D. O. LAWLESS and C. H. SHAEFER. Mr. Bergstrom, also a Purdue graduate, went with the Buick Motor Car Co. in 1923 as tool designer. He was also associated with Dodge Brothers and Nash Motors in a similar capacity. In 1925 he became affiliated with the National Automatic Tool Co. as Chicago representative. Since 1927 he has been actively engaged as special automotive milling specialist for The Cincinnati Milling Machine Co. Associated with him in the Detroit office, with headquarters in the New Center Bldg., will be F. M. GERTISER, O. W. WINTER, J. A. BEEBE, E. M. LEVINE, A. FOERSTER, A. H. MISEL, and C. F. STUEMER. R. E. FIELD, manager of the Chicago office, was assigned to the Chief Engineer's office of the A.E.F. during the war. After the war he joined The Cincinnati Milling Machine Co. and has worked in the Chicago, Cincinnati and Pacific Coast territories as a sales engineer. Associated with him in the Chicago office with headquarters in the Chicago Daily News Bldg., 400 W. Madison St., will be W. F. STEGNER, P. C. HEWETT, C. M. CLARK, R. E. RISLEY, A. F. KNIGHT and E. STICKSEL.

## Diehead Chaser Simplification

The Division of Simplified Practice of the National Bureau of Standards has just announced that Simplified Practice Recommendation No. 51-29, covering diehead chasers (for self-opening and adjustable dieheads) has been reaffirmed by the standing committee of the industry, without change, for another year. It is estimated that this recommendation has been instrumental in effecting a reduction of approximately 75 per cent in the number of stock varieties of this product.

**Left to right: R. E. FIELD, S. E. BERGSTROM, and J. E. CASTER of Cincinnati Milling Machine and Cincinnati Grinders**

# Swiss Machine Industry as a Competitor in International Business

BY OUR BERLIN CORRESPONDENT

When reviewing developments in Switzerland during the last few years, one must necessarily notice that several changes of considerable importance have taken place in its economic structure. In pre-war times, the chief sources of income were foreign visitors and the textile industry. The first-named source has diminished badly on account of the unfavorable economic situation of European countries in general, and the increased catering for tourists by other countries, while the textile industry is at present almost completely dead.

The first endeavor to change the economic structure is seen in the efforts spent on the emancipation of imports in general, and of the machinery industry in particular, from foreign countries; and further, in the fact that Switzerland is earnestly trying to attain a certain degree of importance in international business affairs.

Quite recently a meeting of the Association of Swiss Machinery Works, consisting of 154 works, took place; and on this occasion the general situation of the Swiss industry was discussed, and thus a basis of understanding established for future export developments of this country and its position as a competitor of American and German machinery works on the South American market, as well as in Europe, China and Japan. This discussion may be regarded as the beginning of a new period in the Swiss machinery industry, which thus far had specialized in the manufacture of quality products, rather than mass products; in that the manufacture of cheaper machines, particularly machine tools, is now contemplated.

Owing to the great number of unfilled orders still remaining from 1929, most branches of both the machinery and the electrical industry were satisfactorily occupied during the first half of the year. Then, about the middle of the year signs of depression became apparent, in part wholly unsuspected. The decrease of incoming orders, while affecting all branches, was most noticeable with those manufacturing branches which had before already suffered an internal crisis. Thus, operations of the textile machinery works were most severely encumbered by the effects of the general crisis. A special drawback for Swiss manufacturers is seen in the fact that they were not backed by governmental export credit insurance in the risky Russian business, as in other countries. Therefore, it was earnestly discussed whether the Swiss government should be petitioned to undertake similar steps, which certainly would be of great importance to American- and German-Russian business, because in such case the excellent quality of Swiss products would often prove decisive in the placing of orders, and on the other hand because Swiss engineers and scientists are then sure to be sent to Russia to represent Swiss companies, thereby having considerable influence on the future developments (and placing of orders) of that country, which, as known, is at present greatly influenced by foreigners.

In Switzerland it is regarded as a great obstruction that production costs of the machinery industry are considerably higher than in other countries. This is caused by the generally high standard of living in that country; this problem is to be taken up by Swiss economists, in order also to assist exporters of machines in their efforts to better their chances in international business competition. Furthermore, the Swiss are endeavoring to increase their sales by means of preferential customs agreements and ensuing facilitations for their products. Thus, in 1930, agreements of preference were put into force with Albania and Roumania; new agreements concluded with Belgium, Luxembourg, Turkey and Egypt; and new and advantageous arrangements made with Germany for the import and refining of aluminum-ware.

A well-known fault of European customs policy is encountered in Switzerland too. On the one side every effort is made to raise the export trade, whereas on the other considerable increases in customs rates have been hurriedly fixed (not applying, of course, to countries with which special agreements had previously been made) before the beginning of the planned European Customs Conference which is to be held on application of 28 countries, and for which the economic committee of the League of Nations has already worked out a plan.

This seemingly has been done without anyone noticing the contradiction! The effects are, however, already reflected in reduced sales of Swiss products in Italy; that country, though not officially raising its customs rates, having issued a decree for the benefit of its home industry, ruling that all machines that can possibly be purchased in the home market are not to be bought from foreign manufacturers. This restriction as yet applies to official departments only, but it can be made to include the industry also, in the near future, in order thus to combat at the same time the unemployment problem.

## South American Market

Further, it is worthy of special mention, that the Swiss machine industry intends to carry through jointly an extensive advertising campaign for its products in South America. In this connection, members of the Swiss Association of machinery manufacturers have resolved to create a 52-page propaganda journal to be sent in regular intervals to South and Central America in the Spanish language, and to Brazil in Portuguese. Most likely it will not be long until this combine will also decide to establish licensed factories and selling organizations of its own in the South American countries.

All of this, in the writer's opinion, is a question of the near future; and, by the way, has already been broached by the recent foundation of a selling organization of Swiss machinery manufacturers in Brazil under the leadership of the Oerlikon Machinery Works of Zurich.

Switzerland is by all means endeavoring to overcome the present crisis—its situation must be regarded as such in view of the facts that Japan, a good customer of Swiss goods, is over-saturated, and Australia is pursuing an import-prohibitive customs policy—and all Swiss efforts made to this end must call for attention; because, as everyone familiar with Swiss products knows, manufacture is carried on in large quantities in Switzerland and, with adequate financial aid, may mean a real danger in the international market.

SURVEY OF SWISS MACHINERY EXPORTS TO VARIOUS COUNTRIES

(Figures given in dollars)

| Kind of Machinery | Year | Germany | France | Italy | England | Spain | South America | Other Countries | Total |
|---|---|---|---|---|---|---|---|---|---|
| Machine tools | 1913 | 158,000 | 118,000 | 63,600 | 13,860 | 11,150 | 6,090 | 56,000 | 426,700 |
| | 1928 | 701,000 | 593,000 | 246,000 | 390,000 | 53,800 | 78,250 | 1,064,000 | 3,126,100 |
| | 1929 | 611,000 | 687,000 | 205,800 | 521,400 | 76,500 | 66,200 | 1,525,000 | 3,692,900 |
| | 1930 | 528,000 | 764,000 | 173,700 | 489,000 | 104,000 | 29,800 | 1,194,000 | 3,283,500 |
| Miscellaneous machines and mechanical devices | 1913 | 461,000 | 314,200 | 209,800 | 101,000 | 79,600 | 89,900 | 227,800 | 1,483,300 |
| | 1928 | 591,000 | 744,000 | 357,000 | 342,000 | 255,500 | 239,000 | 1,633,000 | 4,161,500 |
| | 1929 | 533,000 | 767,500 | 340,000 | 390,000 | 212,300 | 371,700 | 1,763,000 | 4,377,500 |
| | 1930 | 472,000 | 877,500 | 275,000 | 520,000 | 171,500 | 177,400 | 1,773,000 | 4,266,400 |
| Hydraulic power machinery, pumps, etc. | 1913 | 218,000 | 195,000 | 122,600 | 105,200 | 219,000 | 38,660 | 576,000 | 1,474,500 |
| | 1928 | 153,300 | 167,800 | 73,500 | 144,500 | 241,800 | 258,400 | 918,000 | 1,957,300 |
| | 1929 | 131,800 | 264,600 | 98,400 | 148,200 | 289,700 | 287,800 | 1,000,200 | 2,220,700 |
| | 1930 | 179,800 | 316,200 | 52,200 | 174,200 | 224,000 | 154,000 | 992,000 | 2,092,400 |
| Spinning machines | 1913 | 139,900 | 91,700 | 68,000 | 6,980 | 1,060 | 33,470 | 43,250 | 384,400 |
| | 1928 | 989,000 | 257,600 | 345,600 | 477,800 | 89,900 | 37,000 | 541,300 | 2,738,200 |
| | 1929 | 409,000 | 356,200 | 327,400 | 254,400 | 84,450 | 114,500 | 899,000 | 2,445,000 |
| | 1930 | 273,500 | 217,400 | 219,600 | 39,340 | 84,250 | 57,950 | 579,000 | 1,471,000 |
| Looms | 1913 | 254,000 | 202,800 | 83,500 | 300 | 29,000 | 36,000 | 102,800 | 708,400 |
| | 1928 | 1,101,000 | 163,600 | 582,000 | 95,500 | 227,400 | 128,000 | 568,000 | 2,865,500 |
| | 1929 | 919,000 | 376,000 | 591,400 | 26,040 | 289,400 | 66,300 | 1,195,000 | 3,463,100 |
| | 1930 | 499,000 | 586,000 | 581,000 | 29,300 | 148,000 | 58,050 | 728,000 | 2,629,400 |
| Weaving machines other than looms | 1913 | 139,700 | 115,800 | 77,700 | 29,600 | 18,160 | 15,360 | 30,900 | 427,200 |
| | 1928 | 749,000 | 284,000 | 275,300 | 332,200 | 94,300 | 124,900 | 796,500 | 2,656,200 |
| | 1929 | 581,000 | 325,000 | 419,000 | 193,000 | 129,600 | 107,700 | 820,000 | 2,575,300 |
| | 1930 | 515,000 | 336,000 | 262,700 | 74,200 | 111,000 | 35,200 | 510,000 | 1,844,100 |
| Knitting machines | 1913 | 29,000 | 86,500 | 50,900 | 39,650 | 3,730 | 2,470 | 71,350 | 283,600 |
| | 1928 | 108,200 | 510,500 | 422,000 | 351,800 | 47,700 | 121,200 | 509,000 | 2,070,400 |
| | 1929 | 176,900 | 660,500 | 438,000 | 376,700 | 64,950 | 155,400 | 614,000 | 2,486,500 |
| | 1930 | 114,900 | 489,000 | 261,600 | 299,000 | 69,350 | 89,200 | 364,500 | 1,687,600 |

# BUSINESS ITEMS

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is using a production line in the construction of ninety locomotives recently ordered by the Pennsylvania Railroad. New machine tools, jigs, dies, cranes, conveyors, and other devices for mass production have been developed and installed. Several of them have been illustrated in previous issues of *American Machinist*.

The Dayton (Ohio) Rubber Mfg. Co. has recently erected another building to furnish additional warehousing and shipping facilities. This is the ninth unit to be erected by the company since it moved to its present location in 1921, and represents an investment of approximately $30,000. Size of building is 160 x 180 ft. It is of brick, concrete and steel construction and was put up in 24 working days.

An official of the E. I. du Pont de Nemours & Co. has been reported to have said that his company was ready to furnish $30,000,000 capital to back the Remington Arms Co. in buying the Winchester Repeating Arms Co., now in the hands of receivers. The du Pont company would thereby have a minority interest in both companies and a larger outlet for its powder. Assets of Winchester Arms would make Remington's total assets of slightly above $60,000,000, the former company having about $30,500,000 and the latter a little more than $29,500,000. The companies are the largest producers of firearms in the country.

The W. C. Ellis & Sons Iron Works, Memphis, Tenn., is celebrating next year its seventieth anniversary. Now, as in former years, it is under the active personal supervision of members of the Ellis family, sons of the founder. W. J. ELLIS is president. HENRY C. ELLIS is vice-president and general manager. The firm was founded in 1862, the year of the Civil War that the Federal troops captured Memphis. The depression has been very light with this company; practically the entire force of 58 employees has been kept intact.

The Packard Motor Car Co., Detroit, Mich., as previously announced, has begun production of motor cars at a plant at Windsor, Ont. The building is a two-story brick structure covering a large portion of a city block. The entry of the Packard Co. into the Canadian field is the fourth large United States manufacturer of motor cars to locate in Ontario since the first of the year, and the second to locate its plant at Windsor.

The "backshop" force of the Cheyenne shops of the Union Pacific Railroad has resumed work on a new schedule which calls for three weeks' work of five days each per month. About 400 employees, principally machinists, boiler makers, electricians and helpers are concerned.

General Electric has contracted for 9,000 sq.ft. in the electrical building of the Chicago world's fair of 1933, the largest exhibit space yet contracted for.

The Fraser Furnace Co., Stockton, Calif., has begun construction of a one-story steel and brick factory building, 110x150 ft. It is the first of two units to be built, the second next spring, according to PRES. RICHARD E. FRASER.

The Ludlow Valve Mfg. Co., Troy, N. Y., will manufacture in Canada as the Canadian Ludlow Valve Mfg. Co., Ltd., with offices at 930 Wellington St., Montreal, Que., and factories at Three Rivers, Que., St. Thomas, Ont., and Fort William, Ont.

The Hoist and Crane Division of Robbins & Myers, Inc., Springfield, Ohio, has appointed W. P. & R. S. Mars Co., Duluth, Minn., as exclusive representative for Robbins & Myers hosits, cranes and trolleys in northern Minnesota and the upper Michigan peninsula.

The Central Specialties Co., Westfield Mass., has been organized to carry on a general machine business, in addition to employing a special process for spraying hot metal on wood and metal.

With the invention of a machine to re-turn brake drums, the Pedrick Tool & Machine Co., Philadelphia, Pa., expects to step up operations shortly. HOWARD A. PEDRICK is president of the firm, which makes a variety of tools and appliances for railroad shops. Other officers are A. D. PEDRICK, vice-president and W. WILLIAM PATTERSON, secretary and treasurer.

Acquisition of the steel tank business, exclusive of truck tanks, formerly conducted by the Industrial Steel Products Co., Emeryville, Calif., has been announced by P. W. MCDONOUGH, owner and manager of the Boiler Tank & Pipe Co., Oakland, Calif. An addition has been erected at the Oakland plant to provide additional space.

Herbert Action Segal & Co., appraisers and liquidators of industrial plants and equipment have moved their office from 45 Mechanic St., to their own building, the Action Bldg., at 8 Centre St., Newark, N. J.

The Tool Equipment Sales Co., 18 S. Clinton St., Chicago, Ill., has moved to 4625 Fulton St.

The Sullivan Machinery Co., with major plants in Illinois and New Hampshire, branches in large cities, and headquarters in Chicago, is reported to have restored all salary and wage cuts made previous to Sept. 1. The company has about 6,000 employees.

Albert G. DeRonde has been appointed receiver for the North Jersey Machinery Exchange, 2 Orange St., Newark.

The George Stant Machine Works, Connersville, Ind., has changed its name to the Stant Mfg. Co.

The Perfect Circle Co., Hagerstown, Ind., maker of piston rings, has seven months' earnings showing a new all-time earning record.

# PERSONALS

A. L. FREEDLANDER, vice-president in charge of production of the Dayton (Ohio) Rubber Mfg. Co., left recently on an extensive trip through European countries, particularly England, France, Germany and Italy. Mr. Freedlander will visit all major motor car manufacturers of Europe, as well as the various plants of the Roderweld Co. The Dayton Company has exclusive manufacturing and selling rights for the Roderweld drive on the American continent.

W. C. BUCHANAN, vice-president of the Keystone Steel & Wire Co., Peoria, Ill., was added to the directorate at the annual stockholders' meeting Aug. 31. He has been with the company for two years, having previously been affiliated with FLOYD A. DEAHL and associates and with the Trumbull Steel Co., Warren, Ohio.

CARL COFFEEN, district manager for several years of the American Wire Fabrics Co., Chicago, has been appointed manager of the wire netting department, Northwestern Barb Wire Co., Sterling, Ill.

WILLI DIENENTHAL, of Dango & Dienenthal, Siegen, Germany, associate of Edgard E. Brosius, Inc., Pittsburgh, designer and manufacturer of steel plant equipment, has been visiting for the past month in the United States.

T. P. DRAPER, vice-president in charge of operations for Sharon (Pa.) Steel Hoop Co., has resigned. No successor has been appointed as yet.

A. R. DUFRESNE, chief engineer of the Canadian Dredge & Dock Co., Ltd., has been placed in charge of the office recently opened by the company in the Dominion Square Bldg., Montreal.

A. J. DUNN, vice-president, and J. C. McMilland, secretary-treasurer of the Chase Foundry & Mfg. Co., Columbus, Ohio, have been given full charge of the company's affairs and jointly succeed S. M. CHASE, vice-president and general manager, deceased. Both have been with the company more than 20 years.

PAUL GAY, for four years past chief engineer of the Charlotte, Mich., plant of the Sterling Mfg. Co., Cleveland, has been appointed chief engineer at Cleveland.

GEORGE H. HANNUM, formerly president of the Oakland Motor Car Co. and later with the Buick Motor Co., has been appointed general manager of the Heintz Mfg. Co., Philadelphia, maker of automobile bodies and other pressed metal products. He was at one time connected with the I. P. Morris Division of William Cramp & Sons.

D. P. KING, general superintendent of the Monessen, Pa., plant of the Pittsburgh Steel Co., has resigned because of ill health.

R. P. LANSING, vice-president of the Bendix Research Corporation, has been made president of the Lubrication Corporation, Chicago, formed by the Bendix Aviation Corp., and the Standard Oil Co. of Indiana to manufacture and market grease fittings for automotive and industrial machinery. The company was incorporated in Delaware under equal ownership of its two sponsors. Machine tools to manufacture the new equipment, now in the blueprint stage, will be built in the South Bend, Ind., Bendix plant.

CHARLES B. OSTRANDER, manager of the Memphis (Tenn.) branch, Ford Motor Co., for past 15 months, has been transferred to St. Paul, Minn., to take charge of the Twin Cities plant. THOMAS J. O'NEIL, assistant manager at Memphis, is in charge of the assembly plant pending arrival of B. W. SLAGLE, formerly assistant manager at Oklahoma City, Okla., who becomes manager.

HARRY M. PERRY, a distributor of small parts, tools, etc., has taken the entire two-story building at 737 No. Spring St., Los Angeles, Calif.

ALBERT H. SHONKWILER resigned Sept. 1 as assistant superintendent of the Otis Steel Co., Cleveland, to become affiliated with the Steubenville (Ohio) works of the Wheeling (W. Va.) Steel Corp.

JAMES E. TAUSSIG, president of the Wabash Railroad system, announced Sept. 9 his resignation after eleven and one-half years in that office and his retirement from active railroad service. He resigned also the presidency of the Ann Arbor Railroad, a Michigan subsidiary of the Wabash. He will devote some of his time in an advisory capacity and will continue on the boards of the terminal companies in which the Wabash is interested. His withdrawal as president comes at a time when the Pennsylvania Railroad is acquiring control of the Wabash.

ARTHUR L. WRIGHT, formerly physical metallurgist with the Linde Air Products Co., Buffalo, N. Y., has joined the Electrolux Co., Richmond, Va., in the sales and service branch.

LEWIS E. PORTER, vice-president of S. F. Bowser & Co., for the last five years, has been transferred to the vice-presidency and managership of S. F. Bowser & Co., Ltd., Toronto, Canada. No successor to Mr. Porter will be named. S. B. BECHTEL, president, also announced the resignation of T. D. KINGSLEY, vice-president in charge of eastern sales.

# OBITUARIES

DR. HARRY PHILLIPS DAVIS, 63, vice-president and director of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and chairman of the National Broadcasting Co., one of the country's foremost engineers and executives, died at Pittsburgh Sept. 10. He had been ill for several months following an operation. Nearly eighty patents were issued to him for his developments in electrical apparatus. Under his engineering leadership many of the most important advances of the electrical art were made, relating to meters, measuring instruments, circuit breakers, railway control apparatus, transmission equipment and radio. For more than 21 of the 40 years during which he was connected with Westinghouse, Dr. Davis was in charge of the engineering department, and for fifteen years directed engineering and manufacturing operations.

HERBERT G. COPP, 60, director purchases and member of the board of Deere & Co., Moline, Ill., died Sept. 2.

JAMES A. DAWES, who has been identified with the Pittsburgh Steel Co. in the sale of hoops and bands for 32 years, died at his home in Pittsburgh, Sept. 4.

CHARLES RICHMOND DAY, 60, formerly general manager of Pittsburgh, (Pa.) Forge & Iron Co., died suddenly at Ambridge, Pa., Sept. 5. He had retired about two years ago after having been connected with the company since 1909.

JULIUS LEWINSKY, 64, president, Lewinsky Iron & Metal Co., Milwaukee, died recently at Elkhart Lake, Wis.

C. W. PRICHARD, president, C. W. Prichard Co., Inc., used machinery dealer, died in Newark, N. J., Sept. 2.

JOHN A. MCAVITY died recently at St. John, New Brunswick, after a long business career in the Maritime Provinces. He was vice-president of T. McAvity & Sons, Ltd., established in 1834 as a manufacturer of valves and fittings and brass and iron products.

ADAM L. GLOOR, 60, owner of the Wayne Tool Co., Detroit, tool manufacturer for 25 years in both Detroit and Dayton, died Sept. 1.

JOHN D. NIES, dean of engineering at Lewis Institute, and vice-president of Kimble Electric Co., Chicago, Ill., died recently at St. Charles, Ill.

WM. J. BROENS, 40, manufacturer of metal parts for vehicles and wagons, died in Memphis, Tenn., recently.

F. J. GLENNON, 31, vice-president and general sales manager of Aluminum Industries, Inc., Cincinnati, Ohio, since 1923, died Sept. 8 after an operation for appendicitis. He joined Aluminum Industries in 1920 as Western field representative.

CHRISTOPHER HOFF, SR., 84, a founder of the Lee-Hoff Mfg. Co., elevator manufacturer, St. Paul, Minn., and its president for nearly fifty years, died Sept. 2 after an illness of two weeks.

SIR THOMAS STANTON, 65, superintendent of the engineering department, National Physical laboratory, and one of the foremost engineers of Great Britain, was found dead Aug. 31 at a Sussex beach where he had been spending a vacation.

# MEETINGS

**NATIONAL METAL CONGRESS AND EXPOSITION**
Exposition on Commonwealth Pier and Congress sessions at Hotel Statler. Boston. Mass., week of Sept, 21. Meetings of A.W.S., A.S.M.E., A.I.M.E., and American Society for Steel Treating in connection. Information from W. H. Eisemann, secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

**SOCIETY OF AUTOMOTIVE ENGINEERS**
National production meeting. Detroit, Mich., Oct. 7-8. John A. C. Warner, secretary, 29 W. 39th St., New York.

**NATIONAL SAFETY COUNCIL**
Twentieth Annual Safety Congress, Chicago, Ill., Oct. 12-16. W. H. Cameron. secretary, 20 North Wacker Drive, Chicago.

**SOCIETY OF INDUSTRIAL ENGINEERS**
Annual meeting, Pittsburgh. Pa., Oct. 14-16. George C. Dent, secretary. 205 W. Wacker Drive. Chicago. Ill.

**GRAY IRON INSTITUTE**
Fourth annual convention. West Baden Springs Hotel, West Baden Springs Ind. Oct. 15-16. J. Arthur Tuscany secretary, Terminal Tower Bldg., Cleveland.

**AMERICAN GEAR MANUFACTURERS ASSOCIATION**
Semi-Annual Meeting, William Penn Hotel, Pittsburgh, Pa., Oct. 15-17. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

**STEEL FOUNDERS' SOCIETY OF AMERICA, INC.**
New York meeting. Oct. 22. Granville P. Rogers, managing director. 932 Graybar Bldg., New York, N. Y.

**SOCIETY OF AUTOMOTIVE ENGINEERS**
National transportation meeting, Washington, D. C., Oct. 27-29. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

**AMERICAN MANAGEMENT ASSOCIATION**
Industrial marketing conference, Hotel Statler, Cleveland, Ohio, Nov. 11-13. Headquarters, 20 Vesey St., New York. N. Y.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS**
Annual meeting, Engineering Societies Bldg., New York, N. Y., Nov. 30-Dec. 5. Calvin W. Rice. secretary, 29 West 39th St., New York. N. Y.

# MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

## Opportunities for Future Business

**Calif., Los Angeles**—Montgomery Properties Inc., c/o W. Richards, Architects Bldg., Archt., awarded contract for a 2 story, 100 x 150 ft. garage and auto sales rooms on South Grand Ave. $150,000.

**Conn., Bridgeport**—Bridgeport Window Shade Co., 197 Stratford Ave., had plans prepared for a 2 story, 62 x 100 ft. factory on Fairfield Ave. Estimated cost $40,000. A. Pokras, Cummunity Bldg. Fairfield, Archt.

**Fla., Graceville**—Rex Lumber Co., plans improvements to planing mill and plant. Estimated cost $100,000.

**Ia., Des Moines** — Interstate Transit Lines, 422 Grand Ave., leased a site at 5th St. and Grand Ave. and plans alterations and remodeling bus depot. Estimated cost $50,000. R. E. Sawyer, 601 Flynn Bldg., Archt. Proposed bus station at 4th and Court Ave. abandoned on account of change in bus routes.

**Ia., Des Moines**—L. H. Kurtz Co., awarded contract for a 1 story repair and service garage at Fourth and Walnut Sts. Estimated cost $20,000.

**Ia., Sioux City**—Western Stages Mfg. Co., c/o K. E. Dunlap, Pres., 809 West 7th St., received low bids for a 1 story, 50 x 100 ft. factory at West 7th and Omaha Sts. Estimated cost $25,000. K. E. Westerlind, 726 Badgerow Bldg., Archt.

**Me., Augusta**—L. D. Flint, 5 Lincoln St., is receiving bids for the construction of a 1 story service garage on State St. Estimated cost $40,000. Edward Sales Co., 443, Portland St., Portland, Archt.

**Me., Dixfield**—Berst-Foster-Dixfield Co., F. W. Smith, Mgr., West Peru manufacturers of wood products, is receiving bids for a 3 story, 105 x 200 ft. factory. Estimated cost to exceed $40,000. H. F. Hallock, Oswego, N. H. Noted Mar. 5.

**Mass., Brockton**—Packard Car Agency, D. W. Packard, 340 Warren Ave., is having plans prepared for a 1 story, 100 x 200 ft. garage on Warren Ave. Estimated cost $60,000. J. W. Beal Sons, 158 Devonshire St., Boston, Mass., Archt.

**Mass., Cambridge (Boston P. O.)** — School Commission, is having preliminary plans prepared for a 3 story technical school on Broadway. Estimated cost $1,500,000. R. H. Doane, 60 Batterymarch St., Boston, Archt.

**Mass., Dorchester (sta. Boston)** — Massachusetts Auto Service, 1228 Massachusetts Ave., is having plans prepared for a 1 story, 60 x 150 ft. auto repair shop. Estimated cost $40,000. R. E. Bossi, 117 East Cottage St., Archt.

**Mass., Worcester**—Sewer Dept., J. H. Brooks, Jr., Supt., awarded contract for a 3 story, 50 x 175 ft. work shop and storehouse on East Worcester St. Estimated cost $150,000. Noted Aug. 27.

**Mich., Detroit**—Chevrolet Motor Co., Holbrook and Dequindre Sts., Dearborn, awarded contract for the construction of a shop at automobile plant here. Estimated cost $55,000.

**Mich., Ecorse** (sta. Detroit)—Murray Body Corp., Clay Ave., Detroit, awarded contract for a 1 story, 100 x 300 ft. automobile body factory here. Noted Sept. 3.

**Minn., Minneapolis**—Twin City Broom Mfg. Co., 413 Lyndale Ave. N., plans to rebuild plant recently destroyed by fire. $15,000.

**Mont., Wolf Point**—State Highway Dept., R. D. Rader, Engr., Division Office, Poplar, will receive bids for a 1 story shop bilding. Estimated cost $15,000. McIver & Cohagen, Strain Bldg., Great Falls, Archts.

**Neb., Hastings**—State Board of Control, H. S. Thorpe, Chn., will soon receive bids for a 1 story machine shop to replace one destroyed by fire, at State Hospital for Insane. $18,000.

**N. J., Elizabeth**—Board of Education, 417 South Broad St., is having preliminary plans prepared for a 3 story manual training and industrial art school. Estimated cost $150,000. H. B. Brady, Inc., 333 North Broad St., Archt. Noted Sept. 3.

**N. J., Maplewood**—Kroydon Co., Burnet Ave., will not construct a 1 story addition to golf club factory. $40,000. D. A. Hopper, 22 Ridgewood Ave., Irvington, Archt. Project abandoned. Noted July 9.

**N. J., Newark** — Charles T. Miller, 1000 Sterling Road, Union City, will build a 2 story, 40 x 10 0ft. factory and stores at 105 Thames St. here. Estimated cost $40,000. Private plans. Work will be done by separate contracts.

**N. J., Trenton**—Kuhn & Jacob, 501 Prospect St., (machinists) plan the construction of a 40 x 175 ft. plant on Oakland St. Estimated cost $30,000.

**N. Y., Elmira**—International Harvester Co., awarded contract for the construction of a sales and service station here. Estimated cost $40,000.

**N. Y., Long Island City**—Queensboro Dairy, will award contract about Oct. 1 for the construction of a garage and service garage at 41st St. and 35th Ave. Estimated cost $40,000. Bids received.

**N. Y., New York**—Baird Television Corp., 145 West 45th St., plans the construction of a plant for the manufacture and assembling of parts. Estimated cost to exceed $40,000, including equipment. Architect not selected.

**N. Y., New York**—Consolidated Laundries, 122 East 42nd St., plans alterations to laundry and garage, 50 x 153 ft. at Wilkins Ave. and 170th St. Estimated cost $60,000. A. Schwartz, 103 Park Ave., Archt.

**N. Y., New York**—Corp., c/o J. Irving, 332 East 149th St., is having sketches made for a 1 story, 103 x 116 ft. service garage at Westchester and Wilkinson Aves. Estimated cost $40,000. Charles Schaefer, Jr., 332 East 149th St., Archt.

**N. Y., New York**—J. M. Horton Ice Cream Co., 205 East 24th St., is having sketches made for a 199 x 220 ft. repair shop and garage at 110 East 131st St. Estimated cost $95,000. J. E. Ross, 25 West 43rd St., Archt. and Engr.

**N. Y., New York**—Kohler & Campbell, 601 West 50th St., manufacturers of pianos, postponed alterations to factory, 6 story, 100 x 125 ft. Ross & McNeil, 274 Madison Ave., Archts. Maturity indefinite. Noted June 25.

**N. Y., New York**—George W. Plunket, 205 East 85th St., awarded contract for converting public stable into service garage at 505 East 116th St. Estimated cost $50,000. Noted Sept. 3.

**N. Y., New York**—Two Hundred Twenty West Sixty First St. Corp., L. Irish, Pres., 60 East 42nd St., awarded contract for the construction of a 100 x 250 ft. service garage at 218 West 61st St. Estimated cost $75,000. Maturity indefinite. Noted Sept. 3.

**N. C., Asheville**—Queen City Coach Co., Charlotte, and Skyland Stages Inc., Asheville, joint owners, plan the construction of a bus terminal here. Estimated cost $75,000.

**Tenn., Chattanooga**—Central Leasing Co., Nashvile, awarded contract for a 2 story, 60 x 150 ft. bus terminal at 10th and Market Sts. Estimated cost $30,000.

**Tenn., Nashville**—State Board of Education, State Capitol, will receive bids until Sept. 29 for the construction of a women's vocational building and men's agricultural and industrial building at A. & I. College, Centennial Blvd.

**Tex., Duncan Field**—A. S. Harrison, Constructing Quartermaster, will soon award contract for the construction of a 447 x 560 ft. engineering shop, dope house, dope storage warehouse, etc. Estimated cost $450,000. Bids received Sept. 14.

**W. Va., Newell**—Edwin M. Knowles China Co., awarded contract for the construction of an electric tunnel kiln at new plant. Estimated cost $50,000.

**Ont., Kitchener**—Bd. of Education, H. W. Brosn., 787 King St. W., Secy., plans additions to Collegiate Institute and Vocational School. Estimated cost $200,000. Architect not appointed.

**Ont., London**—Board of Education, plans addition to technical school. Estimated cost $250,000 including equipment. L. E. Carrothers, Archt.

**Ont., Toronto**—City Property Dept., plans the construction of fire halls, motor repair shop, and new halls at Montgomery Ave., Gerrard St. E. and Keele St., and general improvements. Total cost $212,884.

**Australia, West Perth**—Western Australia Match Co., Ltd., c/o Federal Match Co., Melbourne, plans the construction of a factory here. Estimated cost to exceed $40,000.

## Equipment Wanted

**Mass., Boston**—Bureau of Supplies & Accounts, Navy Yard, will receive bids until Sept. 22 for turret lathes, Diesel electric propelling plant, etc.

**Mass., Everett** (Boston P. O.)—Rankin Co., 48 Florence St.—band saw, jointer, etc.

**Mich., Midland**—Dow Chemical Co.—heat treating furnaces, straightening mill and fabricating equipment for sheets to 5 ft. in width for proposed 1 story rolling mill for magnesium alloy sheets. Estimated cost $50,000.

**Tex., Santa Anna**—Santa Anna Rock & Stone Works, R. D. Goldstein—lathe and polishing machine, gang saw, cutoff saw, rubbing bed, and carborundum planer, for stone and rock quarry. Estimated cost $35,000.

**B. C., Kinsoll**—Marbin Lumber Co.—machinery and equipment for proposed sawmill.

**N. Z., Wellington**—Post and Telegraph Department will receive bids until Oct. 14 for 192 instrument tools.